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PHYSIOLOGIC REACTIONS OF RESTING SUBJECTS TO COOLING POWER AND EFFECTIVE TEMPERATURE*

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INTRODUCTION

IN continuation of the study of problems of ventilation by means of Leonard Hill's kata-thermometer, we have investigated some of the body reactions occurring at various temperatures, namely, about 20°, 25°, 30°, and 35°C., in both relatively dry and moisture laden air, still and in motion, using both naked and clothed subjects. We were interested particularly to determine the losses in weight due to the water which has evaporated from the skin and lungs, and also to test the kata-thermometer against the effective temperature method of Yaglou (1) and his colleagues as an indicator of atmospheric conditions suitable for human beings.

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PLAN OF INVESTIGATION

Three subjects—C. Pergande, J. Haywood, and J. Rogers—who worked as assistants in the laboratory were employed in pairs, P. and H. or P. and R., so that P. took part in all the experiments described; he was 35 years of age, 162.7 cm. in height, and weighed about 56 kg. R. was 18.5 years of age, 170.7 cm. in height, and weighed 64.2 kg.; while H. was 16.3 years of age, 164.5 cm. in height, and weighed about 51.5 kg.

The observations were carried out in a specially designed tunnel (Fig. 1) at this Institute. This tunnel was completely surrounded by an enclosed passage in which were placed heating coils for controlling the temperature and sparge pipes by means of which steam could be ejected to moisten the air as required. A low pressure steam

boiler was placed in an enclosure outside the main structure. The air was kept well mixed by means of two small blowers placed in the passages on either side of the experimental tunnel, with their discharges turned upward. The experimental tunnel was completely closed in except at either end; at one end a 62-inch disk fan (Keith-Blackman) was installed and at the other end there was a honeycomb partition through which the air was directed when the disk fan was in action, the honeycomb eliminating eddies in the air entering the tunnel and thus insuring a uniform velocity distribution. In this way the effects of movement of air at definite velocity (usually about 500 feet per minute) were studied. In addition, when studying effects of almost still air, the disk fan was turned slowly very occasionally to keep the air well mixed in the tunnel and passages.

At the most only two experiments were carried out in any one week, on Tuesday and Thursday. The subjects entered the tunnel at 10 A.M., the engineers having attended previously to the boiler, sparge pipes, and heating coils to obtain the required dry and wet bulb temperatures. In the majority of experiments where clothes were worn, a special set of clothes (shirt, vest, trousers, laboratory overall, socks, and shoes) for each subject had been left hanging in the tunnel overnight, so that all the garments worn by the subjects would be in equilibrium with the air inside the tunnel, the subjects changing their outdoor clothes at 10 A.M. inside the tunnel. Then the subjects sat quietly in a relaxed attitude on chairs with their backs to the honeycomb and, when in moving air, to the wind. In most cases the subjects were in the postabsorptive condition for estimation of metabolism, not having eaten anything since the previous night;

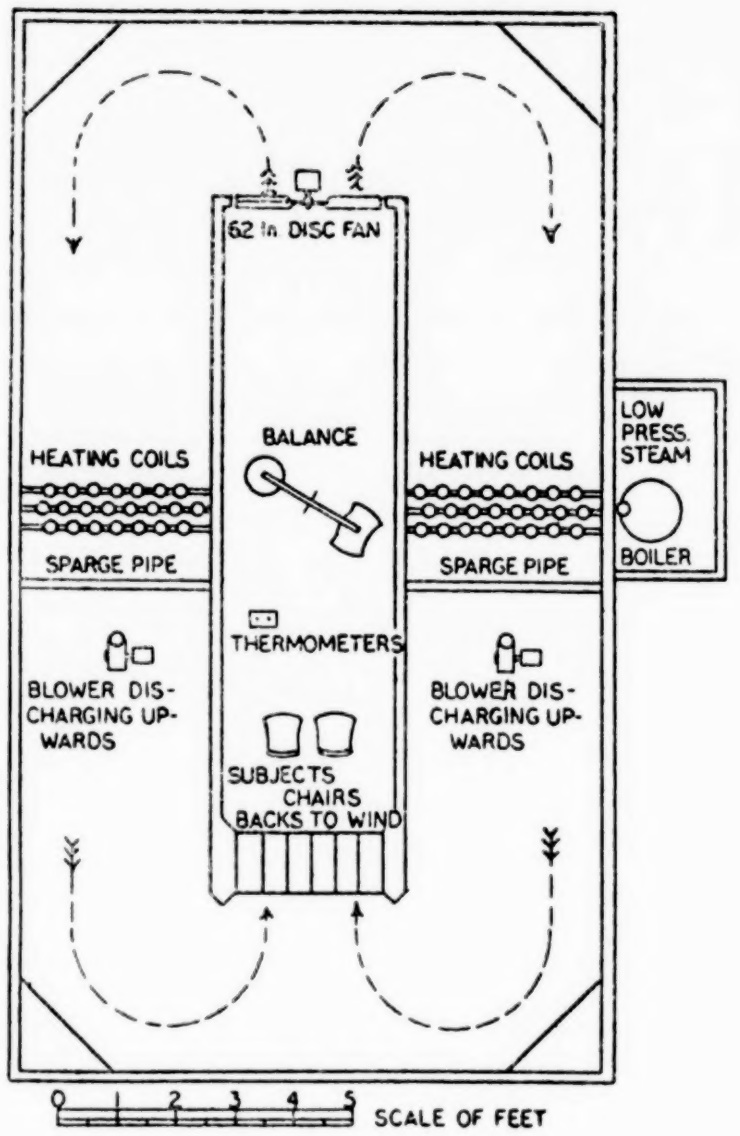

FIG. 1.—Diagram of specially designed tunnel in which observations were made. For description see text.

they were allowed a small quantity of hot tea without sugar and milk before leaving their homes in the morning. After they had sat quietly for at least twenty minutes they were weighed accurately on a balance (Fig. 1) which gave results to the nearest gram; the experiment lasted for from two and one-half to three hours and they were weighed every fifteen or twenty minutes during this period in order to obtain the necessary data for calculating the water evaporated from the body; their clothes were weighed before

and after each experiment. The subjects had to walk a few steps to the balance and sat in a chair which was suspended from one of its arms. In the moist air experiments, care was taken to keep the balance and weights free from moisture while weighing was being done.

After about one hour in any experiment the carbon dioxide output and the oxygen consumption were estimated by the Douglas-Haldane method as recommended by Cathcart (2). During the first half of an experiment, 10 A.M. to 11:30 A.M., the subjects were exposed to almost still air (Table 2); at 11:30 A.M. their clothes were taken off and weighed and then put on again; during the second half of an experiment, 11:30 A.M. to 1 P.M., the subjects were exposed to the same air conditions except that the disk fan was set in motion so as to obtain an air velocity of usually about 500 feet per minute between the adjacent shoulders of the two subjects. With the two subjects sitting fairly close together with their backs to the wind, the velocity of the air at different points of their bodies varied considerably (Fig. 2); thus the velocity in the center of the back was only 210 feet per minute and in front of the chest only 132 feet per minute, while above the head or at the edges of the shoulders and between the legs under the chair the velocity was about 500 feet per minute. When we mention in the text or tables that the air was moving, we mean that the velocity of the air was about 500 feet per minute, estimated at the edges of the body as described above. The velocity of the air was obtained both by means of the kata-thermometer and by a small vane anemometer (Negretti and Zambra) calibrated for us at the National Physical Laboratory.

Omitting here mention of all the preliminary work, five series of experiments—each of four separate experiments—were performed (Table 1); in two of the series the subjects were naked, and in three they were clothed. In two series, namely, 2 and 5, moist air was used. In order to make the conditions clearer we have given full

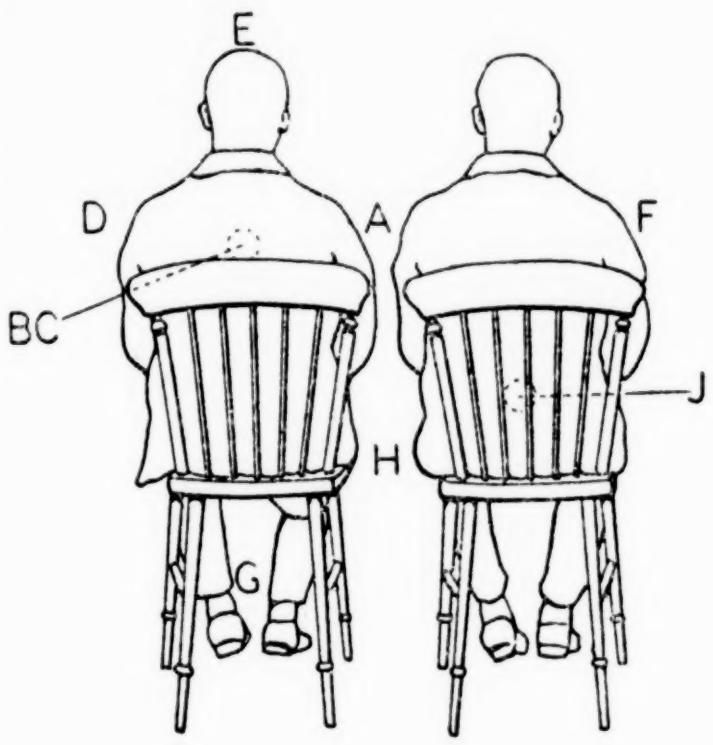

FIG. 2.—Air velocity and cooling power variations at different positions 4 inches from bodies of subjects, with air temperature about 8°C.

Positions	*Dry Kata Cooling Power (millicals./sq. cm./sec.)*	*Air Velocity (ft./min.)*
A. Between subjects' shoulders.....	25.7	480
B. Before chest..	14.6	132
C. Behind back..	17.8	210
D–F. Outer shoulders...	24.6 25.0	445 465
E. Above head...	26.0	500
G. Under chair..	25.4	480
H. Between knees.....	23.8	420
J. In front of abdomen...	16.7	185

details of Series 1 and 2 in Table 2. The atmospheric conditions for Series 3 and 4 were practically the same as those for Series 1, while those for Series

TABLE 1.—OUTLINE OF FIVE SERIES OF EXPERIMENTS PERFORMED

	SERIES 1	SERIES 2	SERIES 3	SERIES 4	SERIES 5
Subjects	P. and H.	P. and H.	P. and H.	P. and R.	P. and R.
Clothes	naked	naked	clothed	clothed	clothed
Air	dry	moist	dry	dry	moist
Dates	9/20/27	10/ 4/27	11/15/27	2/14/28	2/23/28
	9/22/27	10/25/27	11/17/27	1/24/28	3/ 8/28
	9/27/27	10/27/27	11/22/27	1/26/28	3/15/28
	9/29/27	11/ 3/27	11/24/27	2/16/28	3/20/28

TABLE 2.—FULL DETAILS OF ATMOSPHERIC CONDITIONS FROM SERIES 1 AND 2

DATE	AIR MOVEMENT	AIR TEMPERATURE		RELATIVE HUMIDITY	DEW POINT TEMPERATURE	KATA COOLING POWER		EFFECTIVE TEMPERATURE	
		Dry Bulb	Wet Bulb			Dry	Wet		
		°C.	°C.	%	°C.	*millicals. per sq. cm. per sec.*		°C.	°F.
Series 1:									
9/20/27	still	20.4	17.3	75	15.4	4.6	13.0	18.8	66
	moving	22.1	17.9	67	16.7	10.7	30.1	16.1	61[1]
9/22/27	still	25.5	18.8	53	15.7	4.3	15.6	21.7	71
	moving	25.2	19.3	57	16.1	7.7	26.8	17.2	63[1]
9/27/27	still	30.4	20.9	43	16.2	2.3	10.0	24.5	76
	moving	29.7	20.6	43	15.9	6.2	30.2	20.0	68
9/29/27	still	35.0	24.0	40	19.5	0.0	6.9	27.5	82
	moving	35.0	24.0	40	19.5	0.0	26.8	25.0	77
Series 2:									
10/ 4/27	still	22.3	19.9	81	18.7	4.3	12.2	20.9	70
	moving	22.6	20.4	84	19.5	12.7	30.3	14.0	57[1]
10/25/27	still	26.2	24.7	88	24.4	3.3	8.9	25.3	78
	moving	25.9	24.9	94	24.6	9.6	24.5	17.2	63
10/27/27	still	29.5	28.8	95	28.5	1.7	5.5	29.1	84
	moving	30.5	29.9	97	29.8	5.6	14.1	25.8	78
11/ 3/27	still	35.0	34.8	97	34.7	0.0	0.6	34.9	95
	moving	34.5	34.3	98	34.2	1.2	5.0	32.3	90

[1] Velocity of wind reduced on account of shivering.

5 were practically the same as those for Series 2. Broadly speaking all the experiments were performed at, approximately, one of the four dry bulb temperatures 20°C., 25°C., 30°C., and 35°C., and these temperatures have been used freely for brevity in description in the tables and text. In no case was the deviation from these air temperature is an increase in pulse rate. The figures for our observations are given in Table 3.

Although there were some exceptions, on the whole the pulse rates increased as the temperature increased. The cause for the exceptions was not detected, but it was obvious that on some days the pulse rates to start with

TABLE 3.—EFFECT OF AIR TEMPERATURE ON PULSE RATE, IN BEATS PER MINUTE

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR						MOIST AIR			
		Naked		Clothed				Naked		Clothed	
		P.	H.	P.	H.	P.	R.	P.	H.	P.	R.
	°C.										
Still	20	70	60	76	66	64	68	72	62	72	60
	25	62	68	72	82	75	70	72	64	72	68
	30	80	72	74	76	76	80	80	84	88	84
	35	84	68	78	90	68	64	86	92	132	96
Av.		74	67	75	78	71	70	77	75	91	77
Moving	20	66	48	73	64	60	68	70	54	66	60
	25	63	50	66	70	66	60	68	56	66	62
	30	68	59	74	76	70	70	72	84	84	84
	35	80	68	78	96	68	60	76	93	.....	.....
Av.		69	56	73	76	66	64	71	72	.....	.....

temperatures greater than the maximum shown in Table 2. The terms dry and moist are used throughout the text for conditions of air moisture such as are given in Series 1 and Series 2 respectively.

Physiologic Reactions

Pulse Rates

The pulse rates were obtained from the radial artery after the subjects had been exposed for at least forty-five minutes to the conditions specified. A well-established effect of increase in

were lower than on others. Nevertheless, broadly speaking, the usual increase in pulse rate due to heating the body was very noticeable in our results; thus the figures for still air were usually distinctly higher than those for moving air; also in moist air the pulse rates were higher than in dry air, and further in clothed subjects the pulse rates were higher than in the same subjects when naked.

Skin Temperatures

We estimated the skin temperatures by two methods, first by rolling the

bulb of a delicate thermometer over a small area of the skin until constancy was established (about one to one and one-half minutes) and secondly by a thermojunction as used by Benedict (3) and his colleagues. We are aware of the criticism which has been directed against the former method, but this criticism, so far as we can find, is based entirely upon theoretical argument and is, in our experience, not supported by actual observation (see Table 4), the thermometer method at air temperatures above 20°C. giving results much the same—the differences were negligible for our purpose—as those with the thermojunction; this holds good not only for still air, but also for moving air. In the experiments with moist air, the thermometer method was used almost throughout.

Several areas of the skin were investigated and the results under ordinary atmospheric conditions resembled those given by Benedict and his colleagues.

For comparison of effects of various changes in atmospheric conditions on skin temperature, we have used chiefly the temperature of the skin of the cheek, because this is exposed equally in clothed and in naked subjects. The results in Table 5 indicate that, broadly speaking, cheek temperature increased as the air temperature increased; but the figures for naked subjects were not lower than those for clothed subjects, probably because in the clothed subjects more perspiration was being evaporated from the cheek and thus was counteracting the increased heating of the cheek due to lessened heat loss from other parts of the skin which were covered by clothes; again moist air did not appear to affect the cheek temperature definitely or constantly when compared with dry air. On the other hand, wind definitely lowered the cheek temperature, particularly in moist air. To summarize, the cheek temperature may be reduced by decreasing the air temperature or by increasing the movement of air.

TABLE 4.—COMPARISON OF CHEEK TEMPERATURES AS ESTIMATED BY THE THERMOMETER AND BY THE THERMOJUNCTION IN A SPECIAL SERIES OF OBSERVATIONS

SUBJECT	AIR TEMPERATURE		AIR MOVEMENT	CHEEK TEMPERATURE	
	Dry Bulb	Wet Bulb		Thermometer	Thermojunction
	°C.	°C.		°C.	°C.
P.	30.4	20.9	still	36.3	35.9
H.	30.4	20.9	"	36.0	35.6
P.	21.0	16.3	"	34.6	34.3
R.	21.0	16.3	"	33.5	33.0
P.	22.0	15.8	"	34.6	34.6
R.	22.0	15.8	"	34.0	34.1
P.	22.5	14.9	moving	32.0	32.3
R.	22.5	14.9	"	32.0	32.1
P.	25.2	18.2	still	35.1	34.7
R.	25.2	18.2	"	33.0	32.5
P.	25.0	18.0	moving	34.0	33.7
R.	25.0	18.0	"	32.0	31.6
P.	20.4	13.4	"	32.6	32.7
P.	19.4	13.0	still	34.2	34.6

Insensible Perspiration

By insensible perspiration (*perspiratio insensibilis*) is meant the water which has evaporated from the skin and lungs, as estimated by the following:

Total water evaporated from skin and lungs = loss of body weight − (CO_2 output − O_2 intake)

It must be clearly understood that we have included in the term insensible perspiration all water that has any sensible perspiration that evaporates becomes then insensible perspiration.

TABLE 5.—EFFECT OF AIR TEMPERATURE ON CHEEK TEMPERATURE, IN DEGREES CENTIGRADE

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR						MOIST AIR			
		Naked		Clothed				Naked		Clothed	
		P.	H.	P.	H.	P.	R.	P.	H.	P.	R.
	°C.										
Still	20	35.2	33.6	32.6	34.7	33.5	35.1	34.5	33.5	33.0	32.3
	25	34.7	35.2	33.7	33.3	35.2	34.9	.....	35.2	35.4	34.1
	30	36.1	35.2	36.2	35.5	36.5	35.4	37.1	36.3	35.9	35.9
	35	36.7	36.5	36.7	35.8	36.9	36.5	.....	.....	38.0	36.7
Av.		35.7	35.1	34.8	34.8	35.5	35.5	.....	.....	35.6	34.7
Moving	20	33.4	32.0	31.5	29.1	32.6	.....	32.2	30.2	30.0	29.5
	25	34.1	32.9	33.4	31.7	32.9	31.4	.....	33.2	34.1	32.4
	30	35.5	35.1	35.0	34.4	35.3	34.4	35.9	36.0	35.4	34.1
	35	36.3	36.2	36.7	.....	36.9	36.6	.....	.....	.....	.....
Av.		34.8	34.0	34.1	.....	34.4	.....	.....	.....	.....	.....

TABLE 6.—VALUES FOR CARBON DIOXIDE OUTPUT LESS OXYGEN INTAKE, IN GRAMS PER HOUR

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR						MOIST AIR			
		Naked		Clothed				Naked		Clothed	
		P.	H.	P.	H.	P.	R.	P.	H.	P.	R.
	°C.										
Still	20	3.0	5.4	1.2	2.1	1.0	2.2	1.4	4.7	0.0	2.6
	25	2.6	3.9	0.3	2.1	1.6	4.5	1.2	4.9	1.8	3.9
	30	2.8	4.6	0.2	2.8	0.7	5.9	1.2	2.1	1.2	1.2
	35	3.3	4.8	0.0	2.4	1.0	3.6	0.8	4.7	0.9	3.6
Av.		2.9	4.7	0.4	2.3	1.1	4.0	1.1	4.1	1.0	2.8
Moving	20	4.8	3.9	0.0	3.8	0.6	3.5	0.9	4.6	1.2	3.6
	25	0.5	3.4	0.5	3.1	0.0	4.0	2.2	6.5	1.9	2.4
	30	1.5	2.4	0.8	2.9	3.1	0.7	1.2	2.6	0.7	2.3
	35	0.8	4.3	0.0	0.2	1.2	4.0	1.4	4.7	.....	.....
Av.		1.9	3.5	0.3	2.5	1.2	3.0	1.4	4.6	.....	.....

evaporated from the skin and lungs, so that at the higher temperatures The small carbon dioxide output from the skin has been neglected.

The values for carbon dioxide output from the lungs less oxygen intake are given in Table 6. The higher values were obtained when the respiratory quotient was above 0.8 and the lowest values when it was about 0.7. There were no constant and definite differences due to atmospheric conditions.

TABLE 7.—RELATIVE AMOUNT OF WATER EVAPORATED FROM SKIN AND LUNGS (INSENSIBLE PERSPIRATION), IN GRAMS PER HOUR; NAKED SUBJECTS (P. AND H.)

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR						MOIST AIR					
		P.			H.			P.			H.		
		Total	Skin	Lungs	Total	Skin	Lungs	Total	Skin	Lungs	Total	Skin	Lungs
	°C.												
Still	20	27.0	17.4	9.6	24.4	18.1	6.3	28.6	20.9	7.7	22.9	16.9	6.0
	25	35.1	27.4	7.7	34.8	27.3	7.5	32.7	28.2	4.5	24.6	20.0	4.6
	30	47.0	38.9	8.1	37.1	30.5	6.6	37.9	35.5	2.4	45.0	42.7	2.3
	35	95.4	88.1	7.3	100.7	93.8	6.9	122.1	120.1	2.0	90.0	87.5	2.5
Av.		51.1	42.9	8.2	49.2	42.4	6.8	55.3	51.2	4.1	45.6	41.8	3.8
Moving	20	24.1	13.3	10.8	20.5	13.3	7.2	23.2	14.9	8.3	13.7	6.0	7.7
	25	23.8	16.5	7.3	21.8	14.1	7.7	12.5	7.4	5.1	8.3	3.6	4.7
	30	33.6	25.8	7.8	28.9	22.2	6.7	20.6	18.3	2.3	27.3	25.0	2.3
	35	94.4	88.4	6.0	91.7	85.1	6.6	89.2	86.7	2.5	109.7	107.3	2.4
Av.		44.0	36.0	8.0	40.7	33.7	7.0	36.4	31.8	4.6	39.7	35.5	4.2

The figures resemble some of those given by Benedict and Benedict (4, p. 304).

The amount of water evaporated from the lungs alone was obtained from the formula

$$W_1 - W_0 = X \times 1.293 \times 0.625 \times \frac{273}{273 + t_0} \times \frac{P_1 - P_0}{760}$$

where W_0 = weight in grams of water vapor present in volume X liters of inspired air and W_1 = weight of vapor present in the expired air (the weight of water evaporated from the lungs is given by $W_1 - W_0$); P_0 = the vapor pressure in the inspired air, P = the vapor pressure in the expired air, t_0 = centigrade temperature of the inspired air, 1.293 = weight of a liter of dry air at freezing point and 760 mm. Hg, and 0.625 = specific heat of water vapor referred to air at the same pressure and temperature. We have assumed from Tozer and Hill's (5) results that the expired air is saturated with moisture at a temperature of about 33°C. when dealing with dry bulb air temperatures of 30°C. or below. For dry bulb air temperature 35°C. we have assumed that the expired air is saturated with moisture at a temperature of 37°C.

Having calculated from the foregoing formula the amount of water

evaporated from the lungs, the amount of water evaporated from the skin was obtained thus:

Water evaporated from skin = total water evaporated − water evaporated from lungs

as a rule, increased as the dry bulb temperature increased, although there were several exceptions at the lower temperatures tested. When the air temperature was increased to 35°C.,

TABLE 8.—RELATIVE AMOUNT OF WATER EVAPORATED FROM SKIN AND LUNGS (INSENSIBLE PERSPIRATION) IN GRAMS PER HOUR; CLOTHED SUBJECTS (P., H., AND R.)

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR						MOIST AIR					
		P.			R.			P.			R.		
		Total	Skin	Lungs	Total	Skin	Lungs	Total	Skin	Lungs	Total	Skin	Lungs
	°C.												
Still	20	27.4	18.1	9.3	41.0	27.7	13.3	21.8	14.6	7.2	25.6	15.5	10.1
	25	36.3	26.3	10.0	48.7	32.5	16.2	27.7	23.1	4.6	21.6	15.0	6.6
	30	38.5	28.8	9.7	46.2	33.9	12.3	69.7	65.4	4.3	66.6	63.6	3.0
	35	112.2	104.4	7.8	125.2	113.2	12.0	67.1	64.0	3.1	85.7	81.1	4.6
Av.		53.6	44.4	9.2	65.3	51.8	13.5	46.6	41.8	4.8	49.9	43.8	6.1
Moving	20	32.4	21.7	10.7	27.1	12.8	14.3	34.7	26.8	7.9	27.3	17.4	9.9
	25	35.8	25.6	10.2	48.7	34.6	14.1	37.6	32.5	5.1	32.7	26.4	6.3
	30	54.0	44.9	9.1	69.1	56.2	12.9	136.2	132.2	4.0	33.2	30.1	3.1
	35	104.5	96.3	8.2	171.1	159.2	11.9	.....	.....	....	....	....	....
Av.		56.7	47.1	9.6	79.0	65.7	13.3	.....	.....	....	....	....	....
		P.			H.								
Still	20	32.2	23.5	8.7	33.4	24.5	8.9	.....	.....	....	....	....	....
	25	20.1	12.4	7.7	9.3	1.0	8.3	.....	.....	....	....	....	....
	30	72.1	65.5	6.6	88.5	81.1	7.4	.....	.....	....	....	....	....
	35	103.2	95.3	7.9	106.5	96.6	9.9	.....	.....	....	....	....	....
Av.		56.9	49.2	7.7	59.4	50.8	8.6	.....	.....	....	....	....	....
Moving	20	25.0	17.8	7.2	15.3	6.6	8.7	.....	.....	....	....	....	....
	25	35.8	27.3	8.5	29.9	21.6	8.3	.....	.....	....	....	....	....
	30	35.4	29.7	5.7	48.4	40.5	7.9	.....	.....	....	....	....	....
	35	104.9	97.7	7.2	153.4	144.0	9.4	.....	.....	....	....	....	....
Av.		50.3	43.1	7.2	61.7	53.2	8.5	.....	.....	....	....	....	....

The details for the naked subjects are given in Table 7 and those for the clothed subjects in Table 8. Taking the naked subjects first, in accordance with results of previous observers (6) (7, p. 352) the total water evaporated, the increase in water evaporated was enormous, but an increase in air temperature from 20°C. to 25°C. sometimes produced a small increase and sometimes a decrease. The most striking phenomenon, however, was

the effect of wind, the insensible perspiration being greatly reduced by wind, with one or two exceptions at 35°C. Benedict and Benedict did not observe any great effect of wind at 20° to 25°C., but, taking all our results together, the effect of wind in reducing insensible perspiration, as defined by us, appears to be very definite in naked subjects, as a glance at the averages for still air and moving air will reveal (Table 7). Wind removes the still layer of air next the skin, which the hairs of the skin help to maintain (8). Water evaporated from the skin was chiefly concerned in this effect of wind, the water evaporated from the lungs being unaffected by wind and by all other atmospheric conditions except amount of moisture in the air breathed; when the air breathed was moist, the amount of water evaporated from the lungs at the higher air temperatures was greatly diminished (Table 7).

At air temperatures above 25°C. in the clothed subjects (Table 8) the figures for total water evaporated from the body for subjects P. and H. were higher, on the whole, than those for the same subjects when naked (Table 7); Benedict and Benedict (4, p. 298 ff.), like ourselves, found little effect of clothes on insensible perspiration at dry bulb temperatures below 25°C.

With clothed subjects as with naked subjects, the insensible perspiration increased, broadly speaking, when the temperature increased, but wind had no such marked reducing effect, the clothes, of course, preventing the wind from removing the warm still layer of air next the skin.

With clothes there was also some sensible or visible perspiration at temperatures above 25°C., but it has not been included in the results given in Tables 7 and 8 which deal only with water evaporated. The visible perspiration remained on the skin or else was absorbed by the clothes, being weighed with these and thus kept distinct from the water evaporated. The changes in weight of the clothes are given in Table 9. In moist still air at 35°C. the amount of sensible perspiration taken up by the clothes exceeded 1,000 gm. per hour. In this experiment the body temperature had risen from 37.5°C. to 39.5°C. in subject P. In dry and still air at 35°C. there was also a fair amount of perspiration (about 40 gm. per hour on an average) taken up by clothes; when the air was set in motion a good deal of this was evaporated, as shown by the considerable loss in weight of the clothes; when the perspiration was evaporated thus from the clothes, of course it has not been included as water evaporated from the body. In moist and moving air at the lower temperatures (20°, 25°, and 30°C.) there was also a considerable amount of perspiration absorbed by the clothes; this increase was due probably to the fact that the subjects had been sitting for three hours in warm moist air, and were more heated up during the latter half of the experiment, *i.e.*, in moving air, than during the first half of the experiment, *i.e.*, in still air; indeed, under still and moist air conditions at 20° and 25°C. the clothes lost weight, probably because they became warmed up by the body when first put on. A factor of importance is the length of time taken by the mass of body tissue to become heated under the more trying atmospheric conditions.

Another point of interest is the total amount of perspiration, *i.e.*, sensible and insensible, secreted by the skin in the clothed subjects (when naked there was no appreciable amount of sensible perspiration). In the clothed subjects the total perspiration was obtained by adding the sensible perspiration absorbed by the clothes to the insensible perspiration from the skin. The increase in total perspiration (Table 10) at the higher temperatures is obvious, particularly in moist air. Because of the protection afforded by the clothes, the wind did not have any very constant and definite effect. Sometimes in moist and moving air there appears to be a greater secretion than in still moist air; as pointed out in another connection this is not due to wind, but to the fact that the subjects had been sitting longer under the heating conditions. At 35°C. in still moist air the total amount of perspiration was about 1,200 gm. per hour. Of course this large amount

TABLE 9.—LOSS OR GAIN IN WEIGHT OF CLOTHES DURING EXPERIMENTS, IN GRAMS PER HOUR

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR				MOIST AIR	
		P.	H.	P.	R.	P.	R.
	°C.						
Still	20	−7	−3	−14	−10	−14	−6
	25	−9	−25	−2	+2	−23	−20
	30	+10	+2	+1	+3	+18	+54
	35	+40	+58	+40	+26	+1,212	+1,063
Moving	20	−6	−3	+1	+1	+20	+15
	25	−6	−9	−3	−2	+23	+36
	30	−13	−11	−4	+3	+52	+55
	35	−15	−22	−12	−8	.....	.....

TABLE 10.—TOTAL AMOUNT OF PERSPIRATION (SENSIBLE AND INSENSIBLE) SECRETED BY SKIN IN CLOTHED SUBJECTS

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR				MOIST AIR	
		P.	H.	P.	R.	P.	R.
	°C.						
Still	20	23.5	24.5	18.1	27.7	14.6	15.5
	25	12.4	1.0	26.3	34.5	23.1	15.0
	30	75.5	83.1	29.8	36.9	83.4	117.6
	35	135.3	154.6	144.4	139.2	1,276.0	1,144.1
Moving	20	17.8	6.6	22.7	13.8	46.8	32.4
	25	27.3	21.6	25.6	34.6	55.5	62.4
	30	29.7	40.5	44.9	59.2	184.2	85.1
	35	97.7	144.0	96.3	159.2	.....	.....

was not evaporated, so that we must look for another reason for its secretion than cooling by evaporation. Once the body is overheated, removal of water from the tissues is of advantage because conduction is increased from the wetted surface and also because water has a high specific heat and the apart from any effect of evaporation. Of course evaporation of only 100 gm. of water or sweat per hour would remove 57.5 calories of heat from the skin surface, a much greater amount. The obvious treatment of heat stroke is by evaporation induced by fanning the wetted skin rather than by wetting

TABLE 11.—AVERAGE FIGURES FOR RESPIRATORY EXCHANGE IN FOUR DIFFERENT AIR TEMPERATURES: VIZ., ABOUT 20°, 25°, 30°, AND 35°C.

SUBJECT	CLOTHES	AIR: DRY OR MOIST	CO_2 OUTPUT (GM. PER HR.)		O_2 INTAKE (GM. PER HR.)		RESPIRATORY QUOTIENT		VOLUME OF AIR BREATHED (L. PER MIN.)	
			Still Air	Moving Air	Still Air	Moving Air	Still Air	Moving Air	Still Air	Moving Air
P.	naked	dry	25.1	26.6	22.2	22.5	0.820	0.821	5.3	5.3
	"	moist	22.3	23.9	21.6	22.9	0.776	0.759	5.0	5.4
P.	clothed	dry	20.2	18.7	19.8	18.6	0.741	0.734	4.6	4.4
	"	"	21.8	23.7	20.7	22.4	0.762	0.754	5.2	5.5
	"	moist	23.2	24.1	22.3	22.8	0.757	0.766	5.5	5.5
Av.			22.5	23.4	21.3	21.8	0.771	0.767	5.1	5.2
H.	naked	dry	28.1	28.3	23.5	24.8	0.866	0.824	4.4	4.6
	"	moist	27.9	29.7	23.8	25.3	0.846	0.849	5.0	5.2
	clothed	dry	28.6	27.8	26.1	25.2	0.788	0.797	5.2	5.2
Av.			28.2	28.6	24.5	25.1	0.833	0.823	4.9	5.0
R.	clothed	dry	31.3	30.9	29.5	27.9	0.828	0.803	7.9	7.6
	"	moist	31.6	30.2	28.8	27.4	0.795	0.795	7.9	7.2
Av.			31.4	30.5	29.2	27.6	0.811	0.799	7.9	7.4

more water the body contains the slower it will cool down; so far as we know this latter hypothesis for excessive sweating has not been previously suggested. Under cold conditions it is of advantage to retain water for the same reason.

If the temperature of water drunk, say during excessive sweating, is 15°C., a kilogram of perspiration secreted per hour by the skin takes away 22.5 calories of heat from the body quite alone or by injection of iced water into the rectum.

Rubner (6) records some figures which indicate that, compared with dry air, perspiration was decreased in humid air; these observations on the whole covered lower air temperatures (15° to 25°C.) than ours and some of our subjects did exhibit similar results at 20° to 25°C. At these lower temperatures in humid air there is increased cooling of the body by

conduction by the moist air and of course less moisture is taken up by moist air at lower temperatures.

Effects on Metabolism

As it is not possible to present the data in full because of their mass, we shall deal only with detail sufficient to illustrate the main points. Table 11 gives the average figures for carbon dioxide output, oxygen intake, respiratory quotient, and volume of air breathed for each subject; results from twenty experiments with subject P., twelve with subject H., and eight with subject R., a total of forty experiments in all, are included in this table. It is clearly shown that R. had a higher metabolic rate than H. and H. a higher rate than P.; judging from surface area, H. (1.55 sq. m.) should have had about the same or a slightly lower rate than P. (1.59 sq. m.); there was some suspicion that H. was not quite in normal health, thyroid activity being possibly excessive. R.'s surface area was 1.75 sq. m. The higher respiratory quotient of P. when naked and when in dry air was due to the fact that he had fasted only about three and one-half hours in these experiments, whereas in all the others he had fasted for twelve hours at least.

The total number of calories produced per hour in the body has been estimated in the usual indirect way from the oxygen consumed and the respiratory quotient. There was only one experiment, namely, that in moist air at 35°C., in which the body temperature was abnormally high, so that we may regard the figures for calories produced in the body also as the calories lost from the body. The calories lost by evaporation of water from the skin and lungs were calculated in the usual way by taking 575 calories as the heat required to evaporate 1 gm. of water at body temperature 37.5°C. Then we have

Heat loss by conduction, convection, and radiation = total heat loss − heat loss by evaporation

The average results for naked subjects (P. and H.) are given in Table 12. We have averaged their figures since the main points are demonstrated just as well as with the individual data. P. always had a higher total heat loss at the lowest temperature, 20°C., than at the highest temperature, 35°C., while H. gave no constant difference. Moist air, compared with dry air, had no constant effect on total heat loss. Wind caused no great effect except at the lowest temperature, 20°C., where both subjects had a distinctly higher rate, P. shivering excessively at the end of the experiment; physical adjustment sufficed to counteract the effects of wind at temperatures higher than 20°C. The figures in Table 12 show very clearly—in accordance with results of previous workers (6) (7)—how with increase in temperature the heat loss by evaporation increased while at the same time that lost by conduction, convection, and radiation decreased.

With the clothed subjects (Table 13) the same effect of temperature on distribution of heat loss was again well demonstrated, *i.e.*, as heat loss by evaporation increased, that by conduction, convection, and radiation decreased. With regard to the total heat loss, subjects H. and R. when clothed always showed a higher rate

TABLE 12.—AVERAGE FIGURES FOR HEAT LOSS, IN CALORIES PER HOUR; NAKED SUBJECTS (P. AND H.)

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR			MOIST AIR		
		Total	By Evaporation	By Conduction, Convection, and Radiation	Total	By Evaporation	By Conduction, Convection, and Radiation
	°C.						
Still	20	73.7	14.8	58.9	77.0	14.8	62.2
	25	77.4	20.1	57.3	74.6	16.5	58.4
	30	77.4	24.1	53.3	75.2	23.8	51.4
	35	83.0	56.4	26.6	78.6	61.5	17.6
Av.		77.9	28.9	49.0	76.3	29.1	47.2
Moving	20	100.9	12.9	88.0	98.6	10.7	87.9
	25	75.8	13.1	62.7	74.4	6.0	68.4
	30	73.8	18.0	55.8	70.9	13.8	57.1
	35	70.9	53.6	17.3	76.8	57.2	19.6
Av.		80.3	24.4	55.9	80.2	21.9	58.3

TABLE 13.—AVERAGE FIGURES FOR HEAT LOSS, IN CALORIES PER HOUR; CLOTHED SUBJECTS (P., H., AND R.)

AIR MOVEMENT	AIR TEMPERATURE	DRY AIR						MOIST AIR		
		Total		By Evaporation		By Conduction, Convection, and Radiation		Total	By Evaporation	By Conduction, Convection, and Radiation
		P. and H.	P. and R.	P. and H.	P. and R.	P. and H.	P. and R.	P. and R.	P. and R.	P. and R.
	°C.									
Still	20	79.6	80.5	19.0	19.7	60.6	60.8	80.3	13.4	66.9
	25	75.6	83.4	8.5	24.5	67.1	58.9	79.4	14.2	65.2
	30	76.2	77.0	46.2	24.4	30.0	52.6	91.2	39.8	51.4
	35	75.6	89.7	60.3	67.3	15.3	22.4	90.9	44.0	46.9
Av.		76.8	82.6	33.5	34.0	43.3	48.6	85.4	27.8	57.6
Moving	20	72.0	86.5	11.6	17.1	60.4	69.4	86.6	17.9	68.7
	25	76.2	75.6	18.9	24.4	57.3	51.2	80.1	20.2	59.9
	30	70.1	86.2	24.0	35.4	46.1	50.8	85.8	48.7	37.1
	35	74.4	88.7	74.4	79.2	0.0	9.5	.....	.....	.....
Av.		73.2	84.2	32.2	39.0	41.0	45.2	.....	.....	.....

of metabolism at 35°C., while P. more often had a lower rate at the highest temperature. Yaglou (1) and others state that a rise in metabolism is a common result of overheating of the body; nevertheless there are plenty of records (9, p. 304 ff.) of subjects who show a normal and often a subnormal rate of metabolism under hot conditions and in fever; the most that can be claimed is that some resting subjects do, and others do not, exhibit an increase in metabolic rate under warmer conditions. The evidence from researches in tropical climates does not indicate any increase in metabolism; on the contrary many claim to have observed a decrease. The increase when it is observed then must be but a temporary effect and is perhaps evidence of threatened uncompensated overheating.

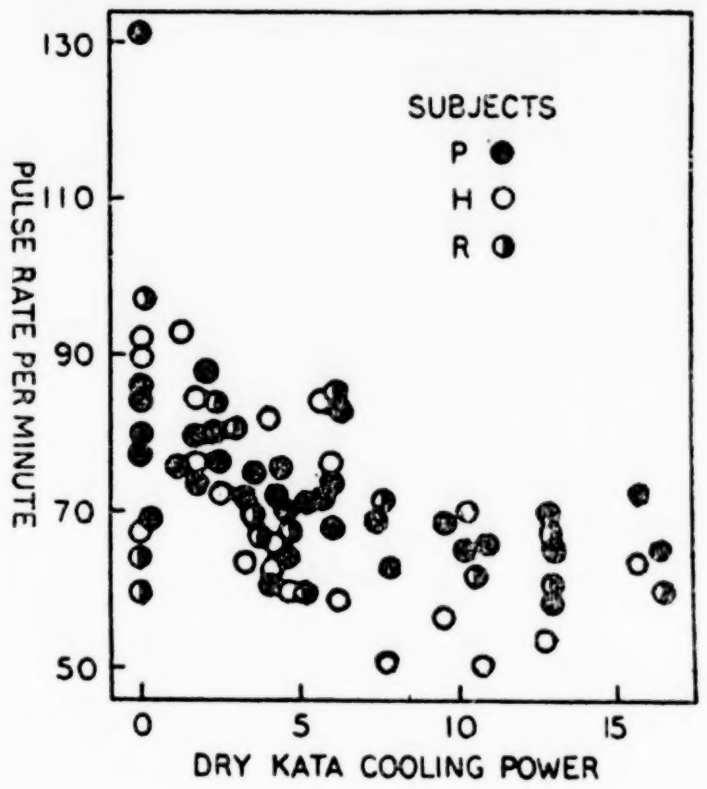

FIG. 3.—Relationship between pulse rate and dry kata-thermometer cooling power.

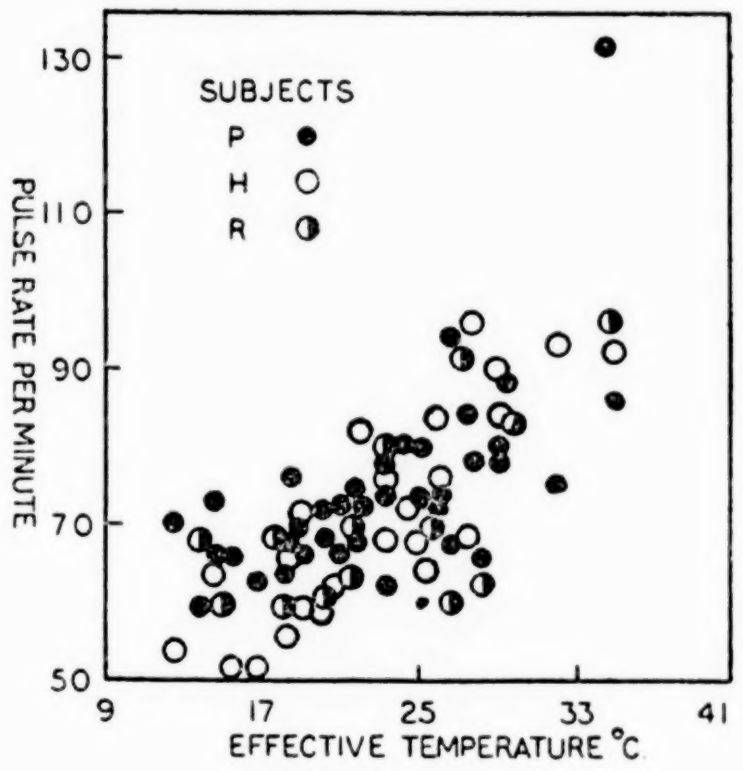

FIG. 4.—Relationship between pulse rate and effective temperature.

RELATIVE VALUE OF KATA-THERMOMETER AND EFFECTIVE TEMPERATURE

The observations for all three subjects employed and under all conditions tested were grouped in tables and the constants determined from these by Dr. P. L. McKinlay of Prof. M. Greenwood's statistical staff.

Since in most instances the relation between the variables is nonlinear (Figs. 3 and 4, 5 and 6, 7 and 8), the correlation ratio (Table 14) is the only suitable statistical constant to use here for comparison; the usual correction has been applied to the tabled values of the ratios. In the first three instances —namely, the correlation of the pulse rate, the insensible perspiration, and the cheek temperature with both effective temperature and kata-thermometer—the relationships are very close, and from the size of the correlations it is reasonable to suppose that one would be able to estimate with a fair degree of accuracy any of these indexes from a knowledge of either the dry kata-thermometer cooling power or the effective temperature. The remaining correlations of metabolism

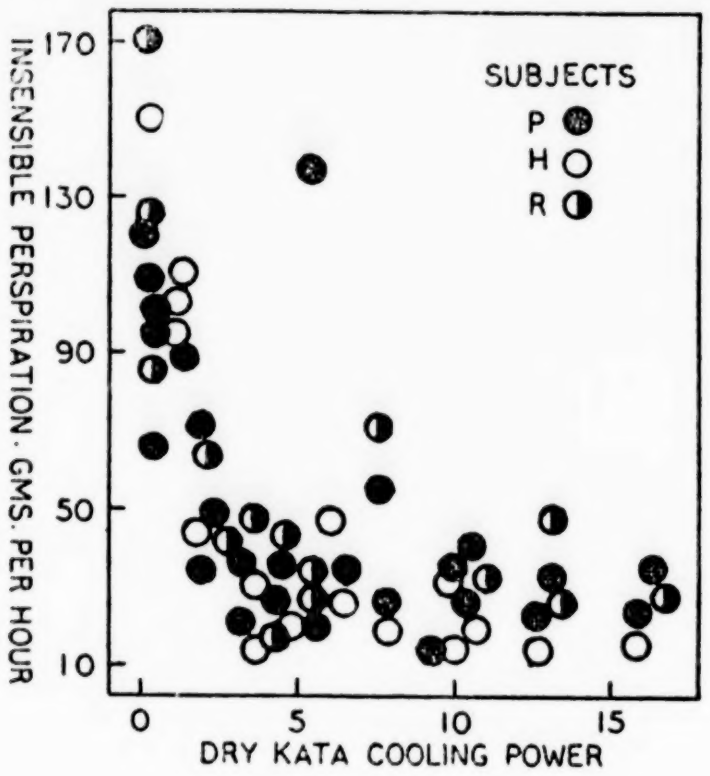

FIG. 5.—Relationship between insensible perspiration (water evaporated) and dry kata-thermometer cooling power.

with effective temperature and kata-thermometer are of no statistical significance; the variables are not associated to any appreciable extent.

In order to determine whether the kata-thermometer or the effective temperature is of greater value for

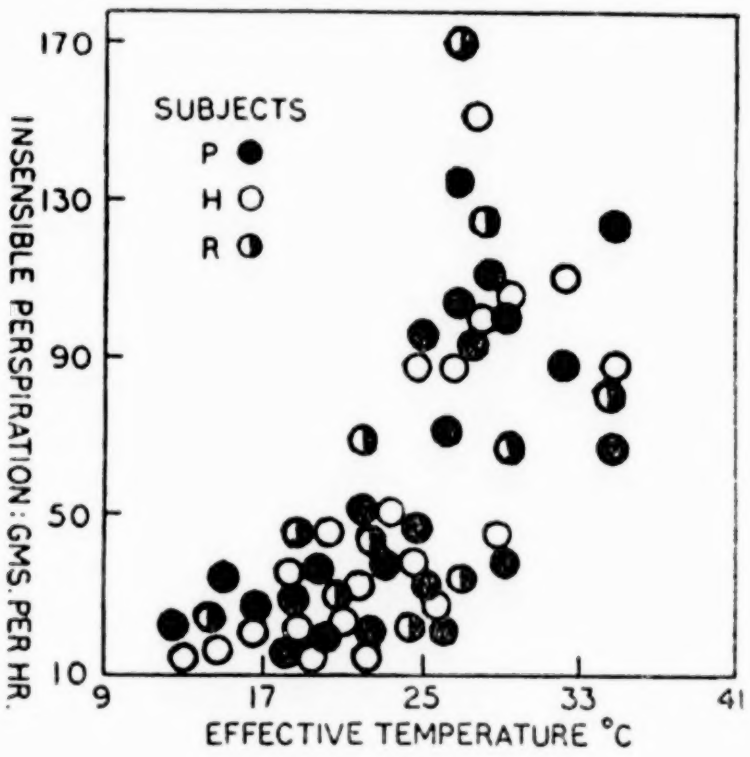

FIG. 6.—Relationship between insensible perspiration (water evaporated) and effective temperature.

prediction, the differences between the coefficients and the probable errors of these differences are also given in Table 14. In two of the four instances the kata-thermometer gives the better result, in the remaining two, the effective temperature; but of these, only one is significant, namely, the difference in the correlations involving pulse rate. Here, however, it is just over 3.5 times the probable error; con-

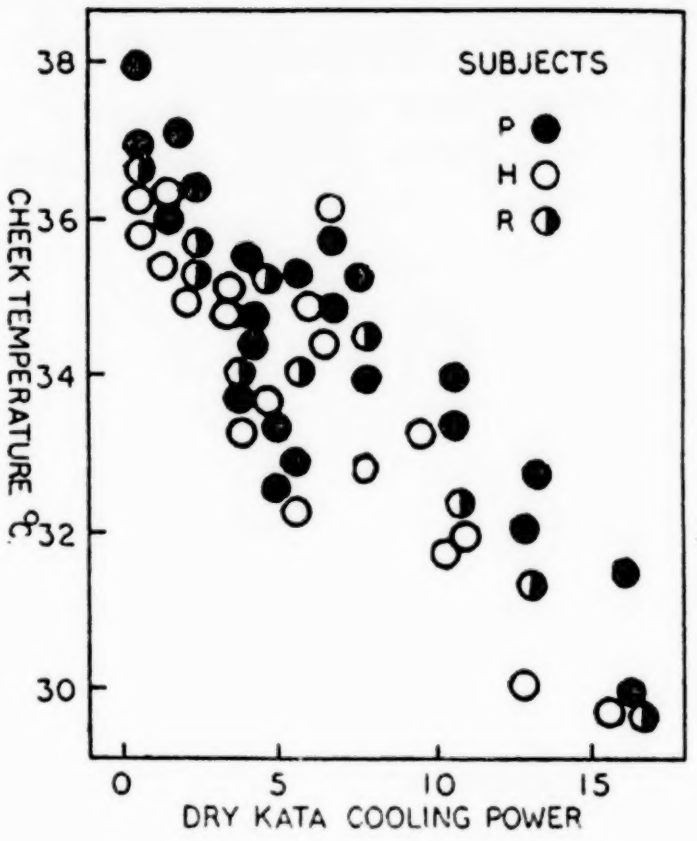

FIG. 7.—Relationship between cheek temperature and dry kata-thermometer cooling power.

sidering the whole series it would seem probable that effective temperature does not take precedence over dry kata-thermometer readings as a measure of physiologic reactions to atmospheric conditions. Both are very good indexes of the specified physiologic reactions, namely, pulse rate, insensible perspiration, and cheek temperature.

In a recent study of the index of comfort in the ventilation of theaters in Sydney, New South Wales, Badham and his colleagues (10) found the

kata-thermometer more reliable than the effective temperature. Also Dudley (11) investigated the value of the kata-thermometer at sea in the tropics with results indicating the value of this instrument; he did not, however, consider effective temperature. Yaglou's claim that effective temperature shows close correlation with physiologic reactions is no evidence that this index has greater value than the cooling power index, because the latter shows equally good correlations with the same reactions. Approaching the problem from a rather different aspect, Vernon (12) reaches a similar conclusion.

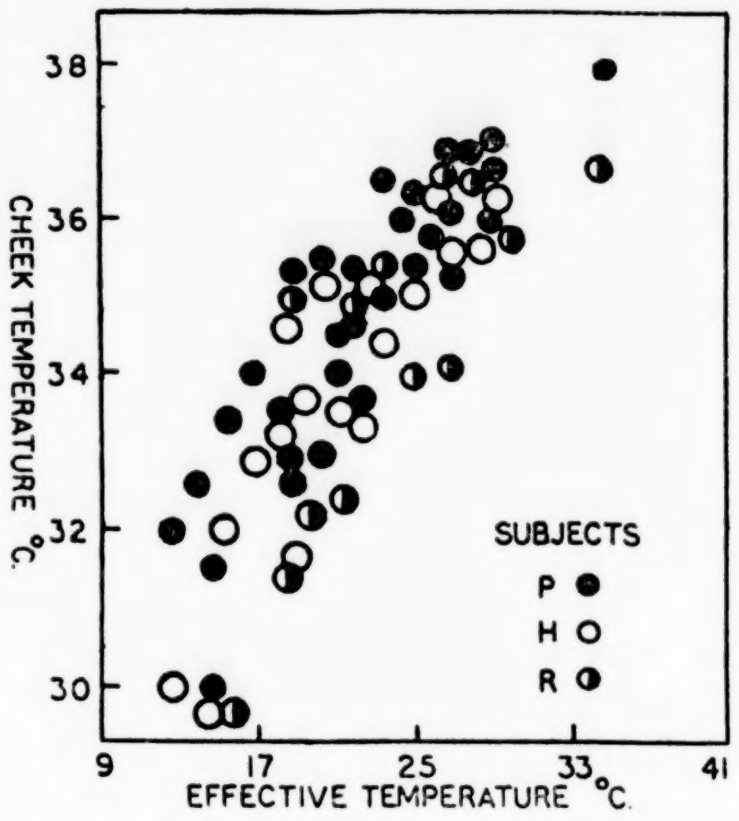

FIG. 8.—Relationship between cheek temperature and effective temperature.

COMFORT

The naked subjects were fairly comfortable in all experiments except those having air temperature at 20°C. and the air in motion; this caused shivering. At 35°C. they were hot, but not very uncomfortable, even with moist still air; wind was always a relief at temperatures of 30° and 35°C. The clothed subjects always felt hot and uncomfortable at temperatures of 30° and 35°C.; wind did relieve these feelings, but only slightly in most cases. There was only one experiment which could not be completed owing to a rise in body temperature; in this experiment the dry bulb temperature was 35.4°C. and the wet bulb 34.5°C., the air being still.

It was not profitable to make a closer examination of comfort conditions because there were only three subjects and they differed greatly in their subjective symptoms. P. was more sensitive to wind when naked than was H.; P., when clothed, was also more sensitive to heating at 35°C. than was either H. or R. It will be remembered that P.'s metabolism was not increased by the very warm conditions as was that of H. and R.; perhaps this explains P.'s greater discomfort.

The experiments did not reveal

TABLE 14.—CORRELATION RATIOS (CORRECTED FOR GROUPING)

PHYSIOLOGIC REACTION	NO. OF OBSERVATIONS	EFFECTIVE TEMPERATURE	DRY KATA-THERMOMETER COOLING POWER	DIFFERENCE
Pulse rate (beats per min.)..	78	0.7845 ±0.029	0.5632 ±0.052	0.2213 ±0.0595
Insensible perspiration.....	78	0.7988 ±0.028	0.8288 ±0.024	0.0300 ±0.0370
Cheek temperature.....	70	0.8538 ±0.022	0.8927 ±0.016	0.0389 ±0.0272
Metabolism.....	78	0.1414 ±0.075	0.0644 ±0.076	0.0770 ±0.1068

any material conclusions regarding acclimatization. P., who had more experience with the conditions, was not so comfortable as R., who had less exposure to the hot atmospheres.

Summary

1. Pulse rate, skin temperature, perspiration (insensible and sensible), metabolism, and heat loss have been studied in naked and clothed resting subjects while they were exposed to dry bulb temperatures at about 20°, 25°, 30°, and 35°C., with still and moving air, and with relatively dry and moist atmospheres.

2. Increase in temperature, within the limits specified, as a rule caused an increase in pulse rate, skin temperature, perspiration, and amount of heat lost by evaporation, while heat loss by conduction, convection, and radiation decreased. Wind opposed these effects in naked subjects only. Clothes increased these effects and antagonized the action of wind. Movement of air and removal of clothes are the obvious remedies for such hot conditions.

3. Insensible perspiration increased from about 20 to 30 gm. per hour at 20°C. to over 100 gm. per hour at 35°C. Sensible perspiration was very markedly increased at 35°C.; at this temperature the body gets rid of water not merely for evaporation, but also because wetting the skin aids conduction of heat and because loss of water enables the body to cool down more rapidly since water has a high specific heat. Moisture in the air, as compared with dry air, has no marked effect on perspiration at the higher temperatures studied.

4. At 35°C., metabolism may or may not be increased. Wind, 500 feet per minute, at 20°C. definitely increased metabolism in naked subjects owing to shivering; at higher temperatures there was no effect of wind on metabolism even in naked resting subjects.

5. Judging from the evidence afforded by pulse rate, water evaporated, and cheek temperatures, the dry kata-thermometer cooling power is as good an indicator of physiologic reactions to atmospheric conditions as is effective temperature; the kata-thermometer has the advantage of being also an excellent anemometer. For such a comparison of two methods, physiologic reactions are, we think, a better guide than comfort sensations.

This research was suggested by Dr. Leonard Hill, F. R. S., to whom we have been indebted for encouragement and advice. Thanks are also due to the subjects who submitted themselves to the tests, to Prof. Major Greenwood, F. R. S., and Dr. P. L. McKinlay for the statistical examination, and to Dr. E. Schuster for the diagrams.

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THE SUMMER COMFORT ZONE: CLIMATE AND CLOTHING*

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IN a previous paper (1), it was shown that standards of comfort, in so far as temperature, humidity, and air movement are concerned, are not absolute, but are considerably affected by climatic and other conditions. This variation appears to be caused by differences in the clothing worn in different climates and at different times of year, as well as by the adaptive physiologic changes[1] which take place in man in response to climatic changes.

The work here described deals with the summer comfort zone as determined by experiments on a large group of men and women wearing customary warm weather clothing and engaged in sedentary pursuits. It includes also a study of the relation of climate and season to the type of underclothing worn.

Experimental Procedure

The experiments were carried out in the psychrometric chamber of the Harvard School of Public Health (2). This room is equipped with a complete heating, ventilating, and air conditioning system for maintaining the desired temperature and humidity conditions.

Preliminary work on the summer comfort zone was begun in July, 1926, but the greater part of the work was done during July, August, and September of 1927. July and August were cooler in 1927 than in other years and September was warmer.

The comfort zone was determined as a result of fifteen experiments, eight of which were conducted with progressively increasing room temperatures (usually in steps of 2° or 3° at a time) and the other seven with decreasing temperatures, in order that the probable optimum temperature might be approached from both the cool and the warm side of the zone. In this way, adaptation to diurnal changes in air conditions was taken into account. In the course of the fifteen tests, a total of 2,901 votes on sensations of comfort were secured.

In addition to these fifteen tests, four special experiments were undertaken for the purpose of determining the influence of room occupancy on the optimum temperature. These data are treated separately.

We have adopted the same classification for sensations of comfort that was used in a previous study (1)—*viz.*,

1. Cold.
2. Comfortably cool.

* For presentation at the Annual Meeting of the American Society of Heating and Ventilating Engineers, Chicago, Jan., 1929. Received for publication Oct. 10, 1928.

[1] This is usually referred to in the literature as "changes in acclimatization."

3. Very comfortable.
4. Comfortably warm.
5. Too warm.

Altogether, ninety-one subjects took part in these experiments—fifty-six men and thirty-five women. About half of them were summer school students or employees of the Harvard Medical School; the other half were secured from employment agencies in Boston. The ages of the men varied from 22 to 57 years, and those of the women from 22 to 72 years; in both instances the majority were between 22 and 37 years of age. No restrictions were imposed in regard to clothing, the subjects being requested to dress in their usual way. The majority of the men wore two-piece palm beach or light weight woolen suits and the women silk, linen, or cotton dresses.

Most of the experiments took place in the afternoon between 1:50 and 5:30 o'clock.

The procedure followed was approximately the same as that used in our previous work (1), with the following exceptions:

a. It was found necessary in some experiments to increase the preliminary period allowed for adaptation from one-half to one and one-half hours, in order to overcome the influence of the preceding environment.

b. No special pains were taken to maintain definite percentages of relative humidity during the experiments, as it was found in previous studies (1) (3) that the sensations of comfort followed the effective temperature[2] scale closely, regardless of humidity. The relative humidity in the present experiments varied from day to day between the approximate limits of 45 and 75 per cent.

c. Dry and wet kata-thermometer readings were taken in all experiments. These data, however, will be given in another paper.

d. Outdoor temperatures were taken on the days the tests were made, for the purpose of determining the influence of outdoor temperature on the optimum temperature indoors.[3]

Air movement in the psychrometric room was determined from the cooling powers of the dry kata-thermometer. By regulating the speed of the supply and exhaust fans and by manipulating dampers, the velocity of the ventilating current was kept between the limits of 15 and 25 feet per minute, as was done in the Pittsburgh experiments on the winter comfort zone (3).

Data and Discussion of Results

The comfort votes obtained in the fifteen regular experiments are classified in Table 1 according to effective temperature. The upper half of the table gives the number of votes for each degree of effective temperature recorded in those experiments in which

[2] Effective temperature is an index of the sensations of warmth or cold felt in response to temperature, humidity, and movement of the air. When the dry and wet bulb temperatures and the rate of air movement are known, the effective temperature can be computed from charts or tables. This index was determined experimentally at the Research Laboratory of the American Society of Heating and Ventilating Engineers. It comprises two different scales: the *basic* (4) for men stripped to the waist and the *normal* (5) for men normally clothed.

[3] The term *optimum temperature* is used in this paper to signify the most comfortable temperature and should be understood in this restricted sense. Since the prolonged effects of temperature, humidity, and air movement on health are not so well known as their effects on comfort, the optimum conditions for comfort cannot be regarded as necessarily identical with those for health.

the room temperature was progressively increased; the lower half of the table gives the data obtained with progressively decreasing room temperatures.

TABLE 1.—COMFORT VOTES CLASSIFIED ACCORDING TO EFFECTIVE TEMPERATURE

SENSATION OF COMFORT	EFFECTIVE TEMPERATURE (°F.) (NORMAL SCALE)																
	62–63	63–64	64–65	65–66	66–67	67–68	68–69	69–70	70–71	71–72	72–73	73–74	74–75	75–76	76–77	77–78	78–79
Increasing Temperature																	
Number of Votes Recorded:																	
1. Cold	.	..	78	64	61	27	11	11	2	...	...	...	...	..	..	..	..
2. Comfortably cool	.	..	2	14	54	50	57	37	33	10	0	1	...	..	..	..	..
3. Very comfortable	.	..	..	..	13	27	53	108	133	56	48	44	14	8	2	..	..
4. Comfortably warm	.	..	..	..	...	...	4	2	16	35	42	45	34	22	9	2	1
5. Too warm	.	..	..	..	...	...	...	...	3	2	6	10	42	28	50	53	59
Totals	.	..	80	78	128	104	125	158	187	103	96	100	90	58	61	55	60
Decreasing Temperature																	
Number of Votes Recorded:																	
1. Cold	9	80	75	71	45	29	24	17	2	1	...	...	...	..	..	..	..
2. Comfortably cool	.	..	3	18	22	44	50	38	32	19	4	3	...	..	..	..	..
3. Very comfortable	.	..	..	1	5	14	25	37	77	68	67	43	27	7	..	..	..
4. Comfortably warm	.	..	..	...	...	...	...	...	6	23	49	51	58	24	10	9	..
5. Too warm	.	..	..	..	...	...	...	...	...	5	25	35	56	36	32	42	..
Totals	9	80	78	90	72	87	99	92	117	116	145	132	141	67	42	51	..

Sensations of Comfort in Relation to Effective Temperature

In Figures 1 and 2, the comfort votes are plotted in percentages as ordinates against effective temperature as abscissas, for increasing and decreasing room temperatures, respectively. The graphs in these two figures are similar and show an optimum temperature of 70.5° effective temperature, a cold limit of 63.5° to 64.5° effective temperature, and a warm limit of 78.5° to 79.5° effective temperature. The coincidence of these values in Figures 1 and 2 is significant, because it indicates that the diurnal adaptation to changing air conditions has been sufficiently allowed for by our experimental method.

Figure 3 shows the combined data of Figures 1 and 2, from which the limits of the comfort zone and the optimum temperature for summer conditions can be taken, as follows:

	Effective Temperature
Probable cold limit	64.0°
Probable optimum	70.5°
Probable warm limit	79.0°

The curves in Figures 1, 2, and 3 are of the asymmetric frequency type and, on that account, the optimum temper-

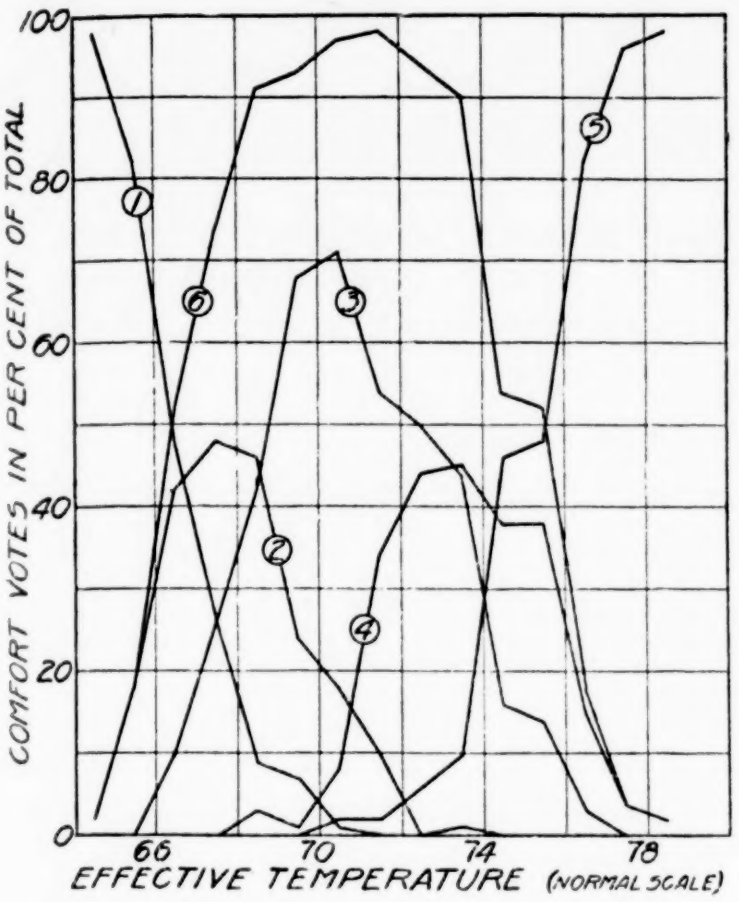

FIG. 1.—Sensations of comfort in relation to effective temperature. Observations with increasing room temperature.
1 = cold; 2 = comfortably cool; 3 = very comfortable; 4 = comfortably warm; 5 = too warm; 6 = sum of 2, 3, and 4.

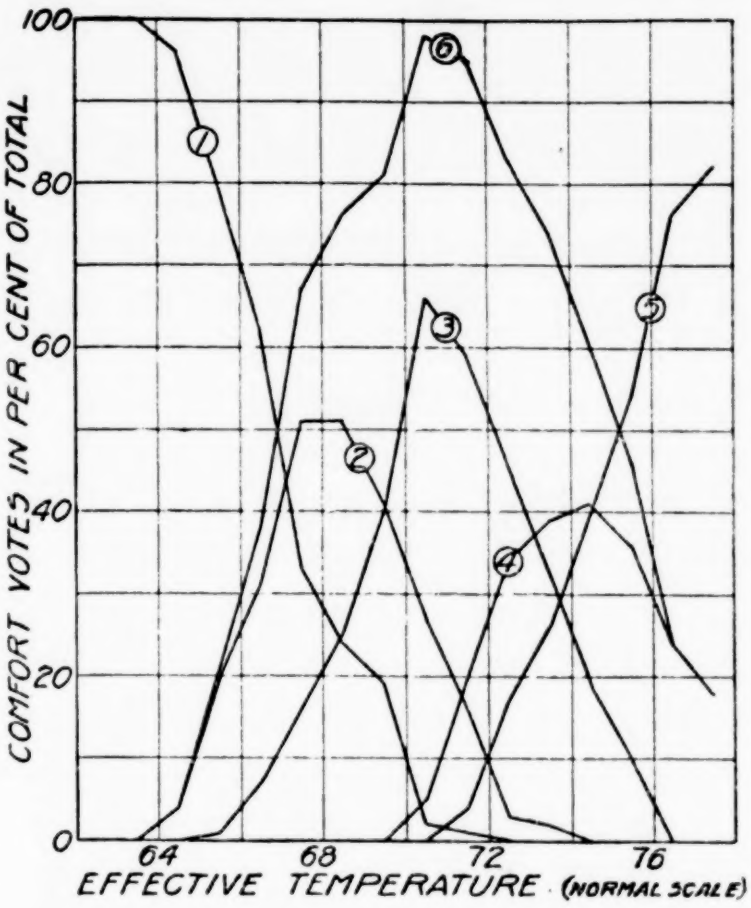

FIG. 2.—Sensations of comfort in relation to effective temperature. Observations with decreasing room temperature.
1, 2, etc., as in Figure 1.

ature does not fall in the middle of the zone but is nearer the cold limit. This observation is thoroughly in accord with the results of previous work in determining comfort zones (1, p. 257) (3, p. 373). The skewness of the curves may possibly be attributed to the fact that, owing to our custom of protecting the body by clothing and artificial heat, the chemical regulation of body heat (*i. e.*, by increase in metabolism) is less well developed than the physical regulation (*i. e.*, by sweating); in consequence we are better capable of perceiving sensations of cold than of heat.

Diurnal and Monthly Changes in Outdoor Temperature in Relation to Optimum Indoor Temperature

In order to make crowded places comfortable during warm summer

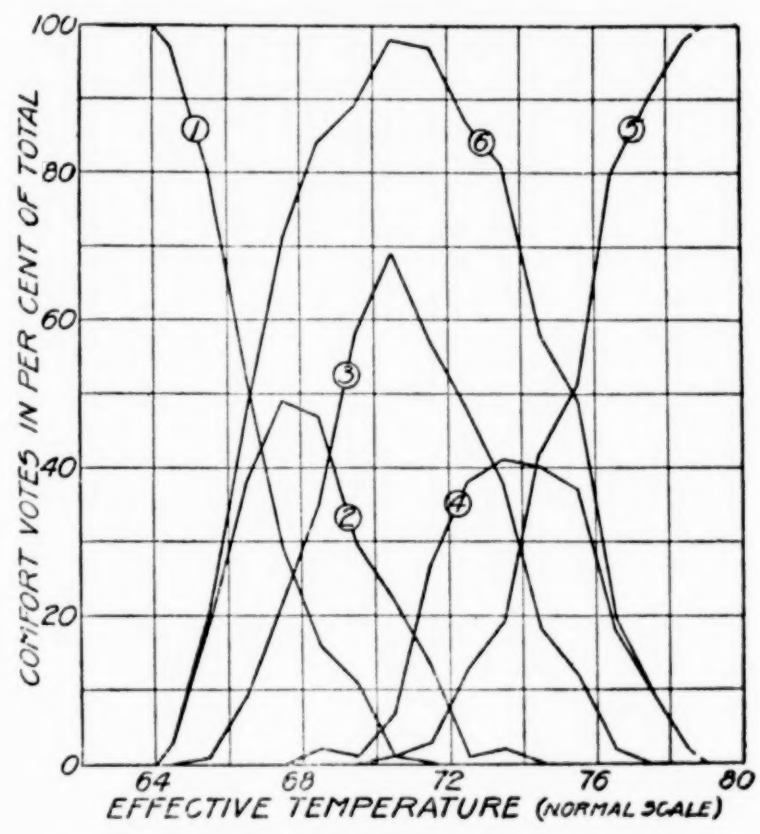

FIG. 3.—Sensations of comfort in relation to effective temperature. Summation of data in Figures 1 and 2.
1, 2, etc., as in Figure 1.

weather, American ventilating engineers have adopted the practice of maintaining indoors, by means of re-

frigeration, a dry bulb temperature 8° to 15°F. lower than that prevailing out of doors. Their chief purpose is not so much to reduce the temperature to the optimum degree as to maintain a reasonably comfortable temperature and, at the same time, avoid causing sensations of chill or of intense heat in entering and leaving the building.

This practice is justified in many crowded public buildings where the patrons spend a comparatively short period of time. According to our experiments, however, it is not adequate for indoor exposures of one and one-half hours or more—for offices, residences, and the like. This may be seen from Table 2, where the optimum temperature is classified in four groups, according to the out-of-door temperature. There seems to be no

TABLE 2.—DIURNAL AND AVERAGE MONTHLY OUTDOOR TEMPERATURE IN RELATION TO OPTIMUM INDOOR TEMPERATURE

PREVAILING OUTDOOR DRY BULB TEMPERATURE	PROBABLE OPTIMUM EFFECTIVE TEMPERATURE (INDOORS)	NO. OF OBSERVATIONS	MONTH	MONTHLY AVERAGE OUTDOOR DRY BULB TEMPERATURE (BOSTON, MASS., 1927)
°F.	°F.			°F.
99–90	70.2	84	July	70.5
89–80	70.9	91	Aug.	67.4
79–70	70.4	109	Sept.	65.0
Below 70	69.3	15	Sept.	65.0

significant relationship between the two, since the optimum temperature in July, August, and September remained practically the same, in spite of the fact that the outdoor temperature actually varied from 99.5° to 70°F. When the outdoor temperature was below 70°F.—when 66°F. was registered—the optimum temperature did drop slightly, as shown in the table, but too much stress must not be laid upon this circumstance because of the limited number of observations, all made in the course of a single experiment. Nevertheless, it is clear that 70°F., or slightly less, is the lowest summer or winter temperature to which people in the United States are adapted in their living and working quarters. It may be taken as the temperature above and below which significant changes in adaptation and clothing are to be expected.

A much more striking correspondence becomes apparent in comparing changes in optimum temperature with changes in the average monthly outdoor temperature. It will be seen from Table 2 that the latter varied by only 5.5°F. from July to September, and it is probably for this reason that the optimum temperature changed so little. The human body cannot, as we have shown elsewhere (1, p. 257), adapt itself readily to changing temperature conditions, but it probably follows the law of averages. The transitory changes in outdoor temperature are only partially felt indoors, because they are mitigated to a considerable extent by passage through buildings. The result is that we become adapted to an indoor temperature which is more equable than that out of doors and which, during the summer season, runs parallel with the mean outdoor temperature. Diurnal changes in outdoor temperature, therefore, may be assumed to affect the optimum indoor temperature, in so far

as they modify the mean seasonal temperature.

Badham and others (6, p. 57), in a study of atmospheric conditions in theaters in Sydney, New South Wales, Australia, also conclude that diurnal differences between indoor and outdoor temperature have no apparent influence on sensations of comfort, so long as the other physical conditions remain the same.

ture wider than the winter zone and that it has shifted to higher temperatures. The probable cold limit rose from 60° in winter to 64° effective temperature in summer, the probable optimum from 66° to 70.5° effective temperature, and the probable warm limit from 74° to 79° effective temperature. Corresponding increases in dry bulb temperature, when the relative humidity is constant at 50 per cent., are

TABLE 3.—SEASONAL VARIATION IN COMFORT ZONE

COMFORT ZONE	EFFECTIVE TEMPERATURE (°F.) (NORMAL SCALE)				DRY BULB TEMPERATURE (°F.) (RELATIVE HUMIDITY 50 PER CENT.)			
	Probable Cold Limit	Probable Optimum	Probable Warm Limit	Width of Zone	Probable Cold Limit	Probable Optimum	Probable Warm Limit	Width of Zone
Summer	64.0	70.5	79.0	15.0	67.5	75.7	86.8	19.3
Winter	60.0	66.0	74.0	14.0	62.6	70.0	80.0	17.4
Difference	4.0	4.5	5.0	1.0	4.9	5.7	6.8	1.9

Seasonal Variation in Comfort Zone

The influence of season on the comfort zone can be observed from Table 3, where the summer zone limits are compared with those found in winter for subjects wearing customary indoor winter clothing. Before proceeding with the discussion, it should be made clear that the zone limits given in the table include the entire range of air conditions voted as cold or warm by all the subjects. The data on the winter zone were obtained from the original report (3, p. 371, Fig. 9) and the effective temperature was converted from the basic to the normal scale. Table 3 shows that the summer zone is 1° effective temperature shown in the right half of the table. We ascribe this variation partly to adaptation to seasonal weather and partly to differences in the clothing worn in the two seasons, as we stated previously.

Vernon (7, p. 394) observed, by means of the kata-thermometer, similar seasonal changes in British factories. He found that, in order to produce a given sensation of air movement, it was necesary to have a dry kata cooling power of about 1 millicalorie per square centimeter per second higher in winter than in summer. This difference he attributes chiefly to acclimatization.

Badham and others (6, pp. 59 and

56), who used Vernon's method in their observations in the Sydney theaters, found little difference between the kata cooling power required to produce a given sensation in winter and that required in summer, but they did observe considerable seasonal change in sensations of air movement. Their results were secured chiefly from the subjective sensations of two investigators, and this was also true of Vernon's experiments.

Influence of Room Occupancy on Optimum Temperature

The greater part of our experiments were carried out with about fourteen people in the test chamber. The gross floor area per occupant was 25 square feet and there was an air space of about 220 cubic feet per person. Allowing for aisles and equipment, the net floor area per occupant was reduced to 11.5 square feet. This condition is comparable to that found in uncrowded lecture and recitation rooms. When the number of occupants was reduced to eight, there was no appreciable difference in the results; when the number exceeded twenty, however, the comfort votes were noticeably affected.

In order to obtain a quantitative measure of this effect, we conducted four special experiments, two with eight subjects in the psychrometric room and the other two with the same eight subjects and seventeen others in addition, so that, with a total of twenty-five persons, the room was reasonably crowded. In all four tests, the room temperature was adjusted to the point of maximum comfort for the original eight subjects, according to their votes, and the relative humidity was kept at about 60 per cent.

Table 4 gives the average results. The probable optimum effective temperature for the eight subjects was 70.8°F. when the gross floor area per occupant was 44 square feet and the air space per occupant 380 cubic feet; it was 69.4°F. when the floor area was 14 square feet and the air space 120 cubic feet per person. The difference is about 1.5°F. in both dry bulb and effective temperatures.

TABLE 4.—INFLUENCE OF ROOM OCCUPANCY ON OPTIMUM TEMPERATURE

NO. OF SUBJECTS IN TEST CHAMBER	FLOOR AREA PER OCCUPANT		AIR SPACE PER OCCUPANT	MOST COMFORTABLE DRY BULB TEMPERATURE	RELATIVE HUMIDITY	PROBABLE OPTIMUM EFFECTIVE TEMPERATURE	OUTDOOR TEMPERATURE	NO. OF OBSERVATIONS (8 CONTROL SUBJECTS ONLY)
	Gross	Net						
	sq. ft.	*sq. ft.*	*cu. ft.*	*°F.*	*%*	*°F.*	*°F.*	
8	44	20.5	380	75.0	60	70.8	77.0	179
25	14	7.5	120	73.4	59	69.4	81.9	164

The cause of this difference is obvious. In the more crowded room, the heat loss by radiation from the bodies of the subjects to the walls and other surroundings was reduced on account of counter radiation between subjects in close proximity. A lower air temperature was therefore required for comfort, in order to offset the decrease in the heat loss by radiation

through an increase in the heat loss by convection.

According to these data, one would expect to find a lower optimum temperature in auditoriums and schoolrooms than in residences, offices, and the like. Although this is probably true for the winter season, in summer an additional factor must be considered. People entering a room from the outside in warm weather are often in an overheated condition and the evaporation of moisture from their damp clothing may produce a cooling effect which more than offsets the decrease in optimum temperature due to crowding.

Comfort Chart

Figure 4 shows the effective temperature chart developed at the Pittsburgh laboratory (3, p. 372, Fig. 10)

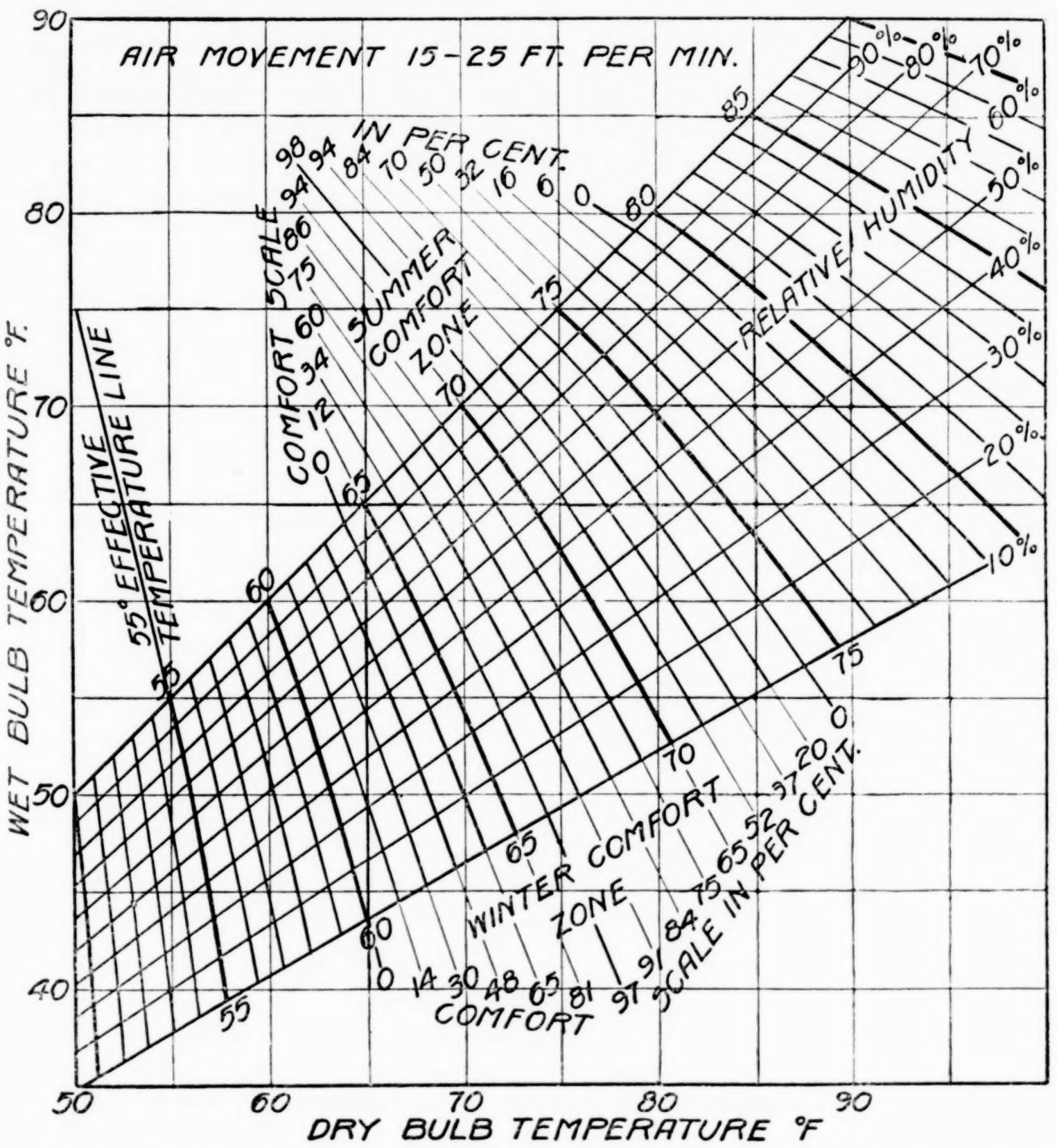

FIG. 4.—Effective temperature chart with comfort zones superimposed. Reproduced by courtesy of the American Society of Heating and Ventilating Engineers.

with the summer and winter comfort zones superimposed upon it. The variation in the sensations of comfort within this zone is indicated by comfort scales. The scale values for the summer comfort zone were obtained from Graph 6, Figure 3, of this paper and those for the winter zone from Graph 6, Figure 9, of the Pittsburgh report (3, p. 371), after converting the scale of effective temperature from the basic to the normal.

Given the dry and the wet bulb temperatures, the effective temperature is found and the probable comfort of the condition determined by referring to the proper comfort scale. This chart is applicable for air movements between 15 and 25 feet per minute. Unfortunately, we have as yet no accurate data on the thermoequivalent conditions of temperature, humidity, and air movement for velocities between 25 and 150 feet per minute. Although such data have, in the past, been estimated by interpolation from observations which actually covered velocities of 15 to 25, 150, 300, and 500 feet per minute (5), recent unpublished observations made in this laboratory indicate that this interpolation is inaccurate and that the region of air velocities between 20 and 150 feet per minute needs special study.

These comfort zones are not applicable where climate, clothing, and heating standards differ substantially from those under which the zones were determined.

Climate and Clothing

A discussion of optimum temperature conditions would be incomplete without considering the factor of clothing, since this, too, is primarily concerned with the regulation of body heat. Climate, of course, largely determines the kind and amount of clothing worn, but its effects are modified to some extent by artificial control of the indoor atmosphere and by national customs and fashions. Differences in international comfort standards may be attributed in part to differences in these two factors—climate and clothing.

In order to study the relationship between climate and clothing, we secured data on the types of underclothing sold in the cold and warm seasons throughout the populous sections of the United States. In order to increase the number of observations for cold weather, we included in our list a few Canadian cities also. This information was secured from eighty men's clothing stores in thirty different cities (Table 5). The cold season was considered to extend from November 1 to May 1 and the warm season from May 1 to November 1. The types of underwear were classified as follows: (*a*) pure wool, (*b*) wool and cotton, (*c*) medium weight cotton, and (*d*) light weight cotton. Table 5 also gives the seasonal outdoor temperature, humidity, and wind velocity for each city, as averaged from the records of the United States Weather Bureau. The temperatures given are the averages for the last fifty-five years. The humidity and wind velocity figures are the averages for the year 1925 alone, but are probably a fair representation.

In Figure 5, the data from Table 5 are plotted in four separate graphs, showing the percentage of the four kinds of underwear sold in the different localities according to their seasonal

TABLE 5.—SEASONAL VARIATION IN UNDERCLOTHING WORN BY MEN IN THE UNITED STATES

CITY AND STATE	COOL SEASON, NOVEMBER TO MAY							WARM SEASON, MAY TO NOVEMBER						
	Average Weather Conditions			Kind of Underwear Worn				Average Weather Conditions			Kind of Underwear Worn			
	Dry Bulb Temperature	Relative Humidity	Wind Velocity	Pure Wool	Wool and Cotton Mixtures	Medium Weight Cotton	Light Weight Cotton	Dry Bulb Temperature	Relative Humidity	Wind Velocity	Pure Wool	Wool and Cotton Mixtures	Medium Weight Cotton	Light Weight Cotton
	°F.	%	mi./hr.	%	%	%	%	°F.	%	mi./hr.	%	%	%	%
Atlanta, Ga	51.3	67	12.8	7	17	28	48	72.7	67	9.0	0	0	6	94
Bangor, Me	29.7	70	11.5	60	30	10	0	57.2	72	8.9	0	0	20	80
Boston, Mass	35.5	62	11.5	1	35	56	8	63.7	66	9.2	0	2	35	63
Buffalo, N. Y	32.0	77	20.3	10	39	16	35	62.0	76	14.7	1	11	22	66
Butte, Mont	28.6	65	7.6	20	45	29	6	58.3	47	8.4	1	5	9	85
Chicago, Ill	34.6	68	12.5	2	31	36	31	65.8	65	10.3	0	1	2	97
Dallas, Tex	51.8	65	8.9	2	6	47	45	78.0	61	8.5	0	1	14	85
Denver, Colo	36.8	55	7.6	5	28	39	28	63.3	43	7.2	0	2	12	86
Detroit, Mich	33.0	73	12.7	5	38	29	28	64.0	62	9.3	1	3	11	85
Duluth, Minn	29.0	81	14.3	5	50	35	10	55.0	73	11.7	2	6	25	67
El Paso, Tex	51.8	38	10.6	2	15	58	25	74.8	33	10.4	0	0	10	90
Galveston, Tex	60.1	80	12.1	5	10	10	75	71.9	73	9.9	5	10	10	75
Jacksonville, Fla	60.5	71	12.9	0	0	5	95	78.0	73	10.7	0	0	0	100
Los Angeles, Calif	57.4	52	5.5	10	10	20	60	67.4	63	5.0	2	1	10	87
Minneapolis, Minn	26.1	62	12.1	5	42	40	13	63.0	53	10.7	1	5	21	73
Minot, N. D	19.0	77	9.6	45	30	20	5	56.0	61	8.6	2	3	35	60
Montreal, Que	24.3	..	15.4	35	55	8	2	59.4	..	11.8	10	12	33	45
New Orleans, La	60.1	70	7.3	5	20	35	40	78.5	65	6.1	1	6	20	73
New York, N. Y	38.1	63	20.5	5	60	30	5	66.6	65	14.9	1	5	19	75
Newark, N. J	38.6	66	19.7	20	25	30	25	66.0	70	15.4	5	10	10	75
Philadelphia, Pa	40.2	59	10.8	10	50	25	15	68.5	63	8.6	5	10	25	60
Pittsburgh, Pa	38.5	67	12.6	20	55	17	8	67.1	67	9.0	0	2	13	85
Portland, Ore	44.7	76	6.3	13	39	32	16	61.4	63	5.8	2	7	34	57
San Francisco, Calif	53.2	70	8.0	10	22	38	30	59.0	72	9.9	2	12	18	68
Seattle, Wash	43.7	75	9.1	5	32	31	32	58.2	69	7.8	0	7	27	66
St. Louis, Mo	40.8	65	13.9	14	20	33	33	71.0	65	11.2	0	0	20	80
Tampa, Fla	64.6	70	6.7	0	2	8	90	79.5	72	6.1	0	0	0	100
Vancouver, B. C	40.5	..	4.7	27	18	37	18	56.9	..	4.4	2	2	50	46
Waco, Tex	55.0	65	8.7	5	5	5	85	78.3	61	8.0	0	0	5	95
Winnipeg, Manit	13.2	..	12.9	44	45	9	2	56.5	..	12.9	10	24	26	40

outdoor temperatures. Although comparatively little woolen underwear is sold in the United States even in cold weather, a definite relationship appears to exist between the mean outdoor temperature and the kind of underclothing worn by the majority of people, regardless of season. Thus,

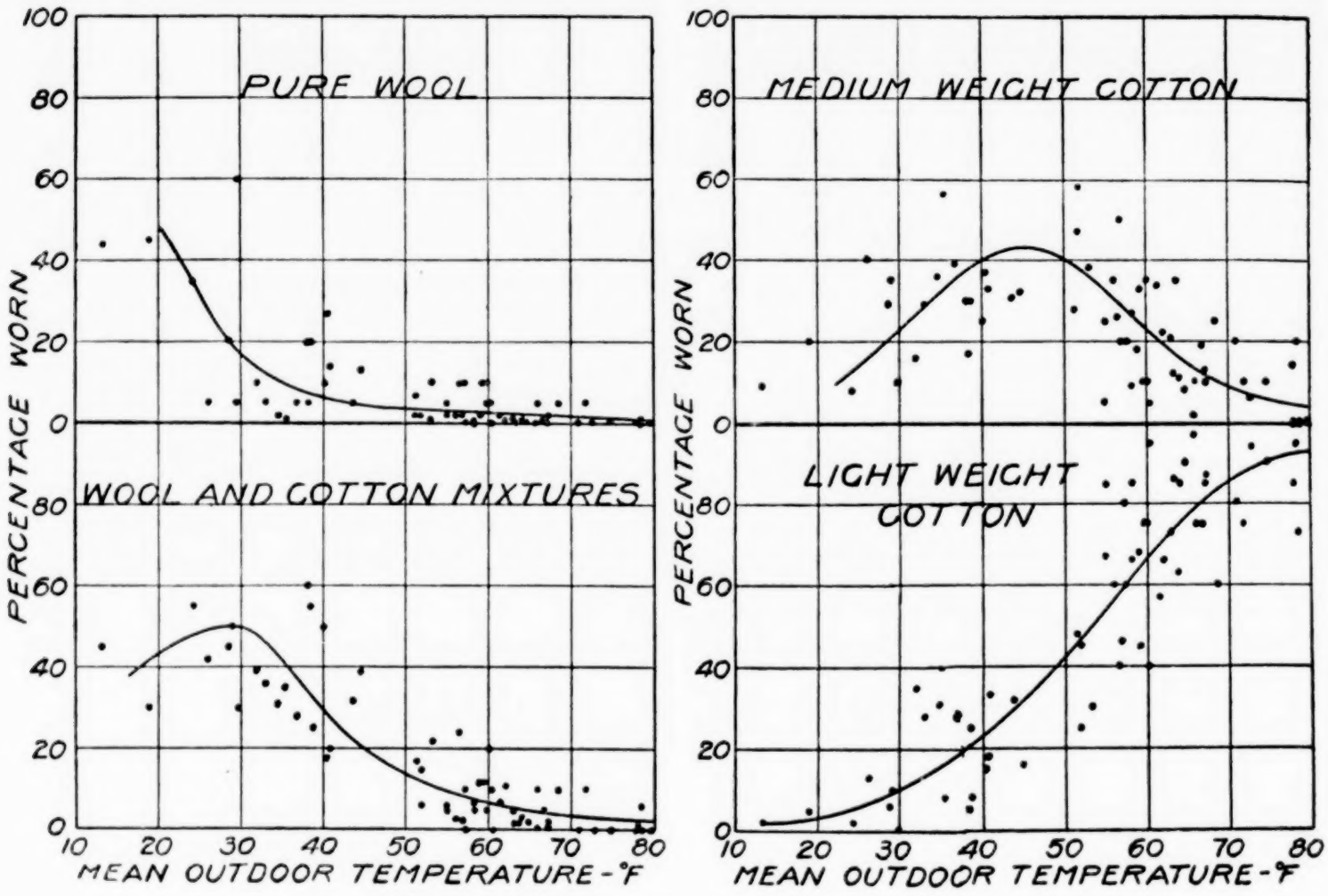

FIG. 5.—Underclothing in relation to seasonal outdoor temperature.

pure wool is popular only in localities where the average winter temperature falls below 20°F.; in cities where the winter temperature varies between 20° and 37°, wool and cotton mixtures are worn by the majority; in warmer cities, where the winter temperature is from 38° to 50°, medium weight cotton is widely used; when the average temperature exceeds 50°, whether in summer or in winter, the greater part of the underwear sold is of the light weight cotton variety.

To take the city of Boston as an example, the percentages of the different weights of underwear sold there in the cool and warm seasons are as shown in Table 6. These values have been taken from Figure 5 and agree as closely as can be expected with those given in Table 5. According to these curves, the representative kinds of underwear sold in Boston are wool and cotton mixtures in the cold season and light weight cotton in the warm season.

In Canada, to judge from the three Canadian cities included in Table 5, it appears that there is an appreciably greater percentage of woolen underwear purchased in summer than in cities in the United States where the same or lower summer temperatures prevail.

TABLE 6.—REPRESENTATIVE TYPES OF UNDERCLOTHING WORN IN BOSTON

SEASON	PURE WOOL	WOOL AND COTTON MIXTURES	MEDIUM WEIGHT COTTON	LIGHT WEIGHT COTTON
	%	%	%	%
Cool (35.5°F.).....	10	40	33	17
Warm (63.7°F.).....	2	5	18	75

All four curves in Figure 5 are of the same general type; they are asymptotic to the temperature axis, indicating that some wool and some light weight cottons are worn at all seasons, no matter what the temperature may be. All four curves show fairly well defined modal regions which represent, approximately, the most popular types of underwear for the specific climates.

The average humidity and wind velocity of the localities included in our study seem to have no noticeable influence on the type of underclothing worn.

The seasonal changes in clothing are not, of course, confined to underclothing. We obtained no data on outer clothing from the clothing stores, but, to judge from the practice of our experimental subjects, seasonal changes in outer clothing are at least as significant as changes in underwear. Thus the greater number of our men subjects wore two-piece palm beach or light weight woolen suits in summer and medium weight woolen or woolen mixtures in winter.

Several of the firms submitting data were of the opinion that the increasing use of the closed and heated automobile and the better heating facilities in living and working quarters accounted for the reduction in the amount of woolen underwear sold today, as compared with that sold ten or twenty years ago.

Influence of Climate, Clothing, and Heating Methods on Comfort Standards

A comparison between the American seasonal optimum temperatures and those found by Vernon in England (7, p. 395, Table 2) show that the American people prefer, in winter and in summer, indoor dry bulb temperatures (Vernon gives no wet bulb readings) which are about 8°F. higher than those considered comfortable in England. In this comparison, we have assumed that Vernon's two investigators, on whose sensations his data rested, are representative of the average sedentary person in England and that Vernon's sensations of "medium air movement" are comparable to our sensations of comfort.

We ascribe this difference in comfort standards in part to the differences in clothing worn in the two countries. As we have pointed out, little woolen underwear is used in the United States even in cold weather; in England, we believe, the contrary is true—woolen underclothing is commonly worn in winter and some prefer it in summer also, in spite of the fact that the English climate is, in general, milder than ours. Hill and Campbell (8, pp. 111 and 117) make these observations: "In this country [referring to England] the average person is generally dressed unsuitably for the heat of summer, when sometimes the conditions are tropical. . . . . It is not surprising that deaths from heat-stroke occur, seeing that in many cases winter clothing is worn. While in tropical climates civilized man often removes his coat in public on excessively warm days, such an event is very rare in London on a similarly oppressive day. Habit and fashion rule, and not the subject's feelings."

According to Figure 5, the representative types of underclothing worn in those parts of the United States where the climate is comparable to that of England are medium weight cotton in

winter and light weight cotton in summer.

In making our comparisons, we must not forget that both outdoor and indoor atmospheres in England are generally more humid than ours, on account of the moist climate and the fact that the air entering the buildings does not have to be heated through such a wide range as it does in our colder climates. Under these conditions, woolen underwear is preferable to cotton.

Adaptation to climate is also an important factor. The intense summer heat to which people in the greater part of the United States are accustomed causes them to require a higher temperature in winter; whereas the intense cold of winter is largely mitigated by artificial heating indoors. Moreover, adaptation to high temperatures may continue during the heating season, on account of the overheating of rooms in mild weather. This condition results, not so much from choice, as from the circumstance that, owing to the changeableness of the American climate, the heating systems have to be designed with ample capacity for making buildings reasonably comfortable during the coldest weather. With the ordinary house heating systems, especially with those using steam as the heating medium, it is difficult to prevent overheating in autumn and spring and in mild winter weather.

In England, adaptation during the winter season works in just the opposite manner. The heating facilities there are not, as a general rule, so adequate as ours, because there is less need for elaborate systems in their climate. Consequently the English people become accustomed to cooler room temperatures, which they partly offset by appropriate clothing.

The difference in heating methods employed in the two countries introduces another factor which merits consideration. With the representative English radiant heating systems, such as coal and gas fires, rooms feel comfortable at a lower air temperature than they do when heated by the American convection methods—steam or hot water radiators and warm air systems. Vernon gave evidence of this (9, p. 56)when he found that rooms heated by coal and gas fires felt comfortably warm at a temperature 7° cooler than similar rooms heated by convection methods.

Summary

The summer comfort zone for men and women in the United States wearing customary warm weather clothing has been found to lie between 64° and 79°F. on the effective temperature scale. The probable optimum is 70.5° effective temperature. On the average, these values are about 4.5° effective temperature higher than those found in winter, when customary winter clothing was worn. The difference is ascribed to adaptation to seasonal weather as well as to seasonal variation in the clothing worn.

A definite relationship is shown to exist between the seasonal outdoor temperature and the kind of underclothing worn. Pure woolen underwear is popular only in those localities of the United States in which the average winter temperature falls below 20°F.; wool and cotton mixtures are preferred in cities having winter temperatures between 20° and 37°F.; in

warmer cities, where the temperature ranges from 38° to 50°F., medium weight cotton is worn by the majority; when the average temperature exceeds 50°F., whether in summer or in winter, the greater part of the underclothing worn is light weight cotton.

The optimum temperature was found to follow the average monthly outdoor temperature more closely than the prevailing outdoor temperature.

It remained at approximately the same value in July, August, and September, probably because the average monthly temperature did not vary much, although the prevailing outdoor temperature ranged from 70° to 99.5°F. A decrease in the optimum temperature became apparent only when the prevailing outdoor temperature fell to 66°F., which is below the customary room temperature in the United States for summer and winter.

Crowding the experimental chamber lowered the optimum effective temperature from 70.8° when the gross floor area per occupant was 44 square feet and the air space 380 cubic feet to 69.4° when the floor area was reduced to 14 square feet and the air space to 120 cubic feet per occupant.

For practical use, the summer and winter comfort zones were superimposed upon the effective temperature chart designed at the Pittsburgh laboratory of the American Society of Heating and Ventilating Engineers. By means of this new chart, the relative comfort of ordinary indoor conditions can be determined from the dry and wet bulb temperatures of the air.

An attempt is made to explain the difference between the English and American comfort standards by differences in climate, clothing, and heating methods.

We wish to express our thanks to the clothing firms which were kind enough to furnish us with their data.

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SOME EFFECTS OF ATMOSPHERIC CONDITIONS ON THE INDUSTRIAL WORKER*

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AMONG the most potent factors affecting the health and efficiency of the industrial worker must be numbered the atmospheric conditions of his workplace. For many years the importance of these conditions has been recognized. Provisions with regard to temperature, humidity, and ventilation were embodied in the Factory Acts as long ago as 1844.

Formerly, ventilation was mostly considered as the replacement of vitiated air by fresh, little regard being paid to temperature and humidity. In recent years, however, the importance of these factors has been demonstrated, and attention has been drawn to the importance of air movement.

Much research on this aspect of ventilation has been carried out of late years, and it is desired in this paper to summarize the results of various investigations.

Theories of Ventilation

Old Theories

It used generally to be taught that the most harmful factors in bad ventilation were the presence of an excessive amount of carbon dioxide and the presence of some unknown organic poison exhaled from the body.

The carbon dioxide theory was refuted by Pettenkofer (1) in 1862 to 1863. He held that the symptoms arising in ill-ventilated places were not due to excess of carbon dioxide, but laid stress on the view that the percentage of carbon dioxide is a guide to the amount of other harmful factors present. In a badly ventilated room the carbon dioxide content rarely exceeds 0.5 per cent., whereas in certain workplaces, *e.g.*, breweries, the concentration may be maintained at even 2 per cent. and men may work there for years without apparent harmful effects. Many famous health resorts at an altitude of 5,000 feet have a lower partial pressure of oxygen than obtains in the most crowded room.

Both Pembrey (2, Appendix IV.) and Boycott (2, Appendix V.) have pointed out that no bad effect ensued from a large carbon dioxide content if the temperature was kept low.

The belief in the organic poison theory is largely due to the writings of Brown-Séquard and d'Arsonval (3). A large number of investigators have repeated their experiments, using greater precautions, with negative results.

The New York State Commission on Ventilation (4, pp. 80–82) after exhaustive experiment found that when persons were subjected to an unventilated atmosphere with a carbon dioxide content rising to 29 to 50 parts per 10,000 their fundamental physio-

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logic reactions of body temperature, heart rate, increase in heart rate on standing, blood pressure, Crampton index of vasotone, and respiration showed no relation to the chemical composition of the atmosphere. A comparison of the results of observations under such conditions with the data recorded when the subjects remained in a well-ventilated atmosphere (under similar conditions of temperature and humidity) revealed no significant difference. The Commission did, however, observe that in the "no ventilation" experiments there was a progressive decrease in the appetite for food as the experiments proceeded. In one series of experiments this decrease in food consumption rose from 2.8 per cent. in the first fortnight to 10.8 per cent. in the next fortnight.

The sum of the available evidence goes to show that the presence of carbon dioxide or of organic substances in expired air cannot account for the ill effects experienced in overcrowded and badly ventilated rooms.

Modern Physical Theory

As long ago as 1713, Cardinal Polignac (Bernan (5)) stressed the need for a constant flow of warm fresh air. Again, a century ago, Heberden (6) suggested the importance, in estimating comfortable and healthy conditions, of measuring the rate of cooling by heating up a thermometer and measuring the time it took to cool through a degree or two.

In 1883 Hermans (7) showed that when several persons were confined in an air-tight chamber for many hours an atmosphere with 15 per cent. of oxygen and from 2 to 4 per cent. of carbon dioxide was not toxic; he attributed the ill effects to the increased temperature and humidity. Later, Flügge (8) and others kept men shut in a small cabinet 3 cu. m. in capacity for four hours until the carbon dioxide content rose to 1 to 1.5 per cent. As long as the air was kept cool and dry no discomfort was felt, and the subjects carried out mental tests without any lowering of efficiency. When the air temperature was allowed to rise to 24°C., the relative humidity to 89 per cent., and the carbon dioxide percentage to 1.2, the subject was very uncomfortable, but no discomfort was felt by those outside the chamber who breathed the air from inside through a tube.

More recently, Hill, Flack, and others (9) demonstrated to what a remarkable extent the discomfort arising from high temperatures could be relieved by increasing the air movement.

A desirable temperature was defined by the Health of Munition Workers Committee (10) as:

a. Cool rather than hot;
b. Dry rather than damp;
c. Diverse in its temperature in different parts, and at different times, rather than uniform and monotonous; and
d. Moving rather than still.

It is these physical factors—temperature, humidity, and air movement—that have such an important influence on the efficiency and well-being of the industrial worker; and it is with the effects of these factors that this paper is concerned. No attempt is made here to deal with the problem of dust.

Atmospheric Conditions in Relation to Comfort

Comfort at Ordinary Temperatures

Various temperatures have been suggested as being most suitable for industrial work. No general agreement has yet been reached as to the most suitable conditions for different types of labor, though it is obvious that the optimum temperature for those engaged in arduous physical work is lower than that for sedentary workers. One American firm (11) worked out the following scale of temperatures which were maintained, as far as possible, in its works:

	°F.
Rooms where men are moderately active and able to move about	65–67
Foundry, smiths' shop, and carpenters' shop, where active work is the rule	55–65
Storage rooms where men are not regularly employed	40–50

The Organiser (12) recorded the average temperatures at a number of factories "where complaints are infrequent" as follows:

	°F.
Factories where sedentary work is performed	58–66
Those with light labour at machines	50–61
Those with heavy labour at machines	46–51
Those with heavy manual labour	44–48

These latter temperatures are considerably lower than those laid down by the American firm, and are certainly lower than most industrial workers would approve of.

For operatives in shoe factories, Hambly and Bedford (13) suggested a temperature of 65° to 67° for sedentary work such as clicking, one of 60° to 65° for active work such as sole cutting, and one of 55° to 60° for fairly heavy operations such as lasting and edge setting.

For the continuously active, but not heavy, work carried out in potters' shops, Vernon and Bedford (14) recommended a mean temperature of 62.5° as the ideal to be aimed at. They recognized, however, that this could apply only to periods when the outside temperature is low or moderate, and suggested the following ideal temperatures for a factory where active (but not heavy) work is carried on:

Outdoor Temperature °F.	*Factory Temperature* °F.
60 or less	62.5
65	65.0
70	69.0
75	73.0

That these are *practicable* ideals they demonstrated by recording observations made in a fuse factory.

Leonard Hill has suggested as suitable a scale of dry kata cooling powers ranging from 6 for sedentary workers to 18 for those engaged in heavy work. If these standards are to be comfortably maintained they imply a considerable variation in temperature for different types of workers, as, though cooling powers of 6 or 18 could both be obtained with, say, a temperature of 60°, neither would be really satisfactory. With the cooling power at 6 the air velocity would be only 10 feet per minute, and with the cooling power at 18 the velocity would be 469 feet per minute. The former velocity is very low and such as occurs only in badly ventilated rooms, while a velocity of 469 feet per minute would be dis-

tinctly uncomfortable. Vernon, Bedford, and Warner (15) found that with velocities of this order dust was blown up from the floor in clouds.

Baetjer (16) states that the value of the threshold air velocity for the skin of the cheek varies from 0.15 to 0.65 meter per second (30 to 128 feet per minute) with air temperatures from 12° to 30°C. (53° to 86°F.). At normal room temperatures the threshold current has a velocity of 18 to 59 feet per minute.

Sensations of Freshness in Relation to Cooling Power.—In order to graduate the kata-thermometer empirically, Vernon, Bedford, and Warner (17) recorded their sensations of freshness systematically before each determination of cooling power, according to an agreed scale. They found that in order to produce a given sensation of freshness in the winter it was necessary for the air to have a cooling power 1 unit higher than that required in summer. This difference of standard was largely due to temperature, which was 7°F. higher in the summer than in the winter, though its effects were to some extent neutralized by the increased air velocity, which was usually about 9 feet per minute greater in the summer. As the sensation of freshness experienced progressed through each stage from "very stagnant" to "very fresh," the cooling power rose steadily in correspondence, but the two components showed no such uniformity of rise. The observations showed quite clearly that the sensation of freshness experienced cannot be measured in terms either of temperature or of air velocity, but needs a combination of the two, such as is given by the cooling power of the kata-thermometer.

The correlation between sensation of freshness and atmospheric conditions was determined by calculating the correlation ratios. It will be seen from Table 1 that there was a high correlation between sensation of freshness and cooling power both in summer and in winter. There was also a high correlation between sensation and temperature in the winter observations, but a rather low correlation with air velocity. In the summer observations the correlation was fairly high both with temperature and with air velocity.

TABLE 1.—CORRELATION OF SENSATIONS OF FRESHNESS WITH ATMOSPHERIC CONDITIONS

CORRELATION RATIO OF	SUMMER OBSERVATIONS	WINTER OBSERVATIONS
Cooling power on sensation	0.703 ±0.023	0.790 ±0.018
Temperature on sensation	0.531 ±0.032	0.740 ±0.021
Air velocity on sensation	0.569 ±0.030	0.381 ±0.041

Sensations of Freshness in Relation to Variability of Air Currents.—It is generally supposed that variable air currents cause a feeling of greater freshness than steady currents. To test this hypothesis Vernon, Bedford, and Warner used a hot-wire anemometer whereby they were able to obtain a direct measure of the velocity of the

air currents at intervals of two and one-half seconds. Meanwhile a second investigator synchronously read a second galvanometer attached to a thermopile. These instruments were read for five-minute periods and altogether 120 readings were obtained.

The correlation ratio between velocity oscillations and sensation of freshness was found to be 0.365 ± 0.039 in summer and 0.418 ± 0.039 in winter. When, however, the ratios were confined to the observations having air velocities of less than 50 feet per minute in summer and 40 feet in winter, the ratios fell to 0.255 ± 0.051 and 0.371 ± 0.045, respectively. From this it appears that oscillations of air velocity have only a moderate effect on sensations of freshness. They are less effective than the actual speed of the air current. No clear proof was obtained of the effect of temperature oscillations on sensations of freshness.

Acclimatization.—It has been pointed out that in order to produce a given sensation of freshness in the winter it was necessary for the air to have a cooling power 1 unit higher than that required in the summer. The differences observed between the summer and the winter results were due chiefly to acclimatization. This is strikingly shown when the observations are split up into five groups according as they were made in June, July and August, September, January, or February and March. The means of the cooling powers in each monthly group show a linear relationship to the mean indoor temperatures observed at the time the cooling powers were ascertained. The cooling power corresponding to an air temperature of 60°F. is almost exactly 7 with a correction of ±0.15 for each °F. below or above this temperature. Thus at 70° the cooling power is 5.5 and at 50° the cooling power is 8.5. These cooling powers correspond closely with those observed when the sensation of freshness was judged by the investigators to be medium.

In order to get further evidence relating to subjective sensations Vernon, Bedford, and Warner (15) systematically questioned individual workers in various factories at the time they were making determinations of cooling power. They asked them to say whether they considered the conditions "comfortable" or "too warm" or "too cold," and if they offered either of the two latter opinions they were asked whether they considered them "much too warm" or "much too cold." Altogether 1,166 expressions of opinion were obtained in winter (October to March) and 1,308 in summer (May to September).

On the whole, the opinions of the workers agreed very well with those of the investigators themselves. On the average it was found that in order to produce a given sensation the cooling power needed to be 0.8 unit higher in winter than in summer. This is in rough correspondence with the 1.1 units found by the investigators. The difference was due chiefly to the lower temperatures experienced in winter. It was found that a given sensation of comfort was felt in winter at a temperature about 5° lower than in summer. Taking the mean values required to induce a "comfortable" sensation as the standard it was found that on an average a "too warm" or "too cold" sensation was produced by

a rise or fall of about 4° in temperature and a fall or rise of about 1 unit in the cooling power.

Data are recorded showing that in two rooms where the atmospheric conditions differed considerably from the general mean the operatives became more or less acclimatized. On the other hand, in a factory where the cooling power was kept nearly steady throughout the year, the acclimatization was very small, and a "comfortable" sensation was experienced both in summer and in winter alike with a cooling power of 6.5.

The need for acclimatization to adverse conditions was mentioned by Orenstein and Ireland (18) in describing observations on native mine workers in the Rand. They say that it is not advisable to put a native just back from holiday, or a new recruit, in a bad place. He will probably do better in the hot place after some training in good or moderately good places.

Moss (19) also emphasizes the importance to miners of acclimatization.

Effective Temperature in Relation to Sensations of Comfort.—Concerning the effect of various atmospheric conditions on subjective sensations of comfort, numerous investigations have been made by Yaglou, Houghten, Miller (20), and others at the laboratory of the American Society of Heating and Ventilating Engineers, Pittsburgh. Various combinations of temperature, air velocity, and humidity causing the same sensation of comfort were determined. From the results of large numbers of observations the investigators constructed two thermometric charts, one applying to persons normally clothed and the other to persons stripped to the waist. From these charts any combination of dry and wet bulb temperature and air velocity can be combined into a single value termed "effective temperature."

The findings of Yaglou and his associates have been criticized by Vernon and Bedford (17) on the ground that comparisons of comfort made by the two-chamber method suffer from the fact that they take no account of acclimatization. Controversial papers have been published in THIS JOURNAL (21) (22) (23) (24) (25).

Yaglou (24) suggests that the effect of acclimatization is overestimated, and the influence of clothing underestimated. He gives as probable optimum temperatures those shown in Table 2.

TABLE 2.—SEASONAL VARIATION IN OPTIMUM TEMPERATURE

SEASON	PROBABLE OPTIMUM TEMPERATURE
	°F.
Winter (winter clothing).....	70.0
Summer (summer clothing).....	75.7
Winter and summer (stripped to the waist).....	80.0

Vernon, Bedford, and Warner (15) suggested cooling powers varying from 7 to 6 in places where light industrial work is performed (see Table 3). These practicable ideals were very nearly attained at one of the factories examined.

TABLE 3.—SUGGESTED IDEAL COOLING POWERS FOR LIGHT INDUSTRIAL WORK

	OUTDOOR AIR TEMPERATURE				
	Under 40°	40°–49°	50°–59°	60°–69°	70° or more
Cooling power.....	7.0	6.9	6.8	6.5	6.0
Indoor air temperature (°F.)...	61.6	62.0	63.6	67.9	74.6
Air velocity (ft. per min.).....	29	30	35	50	100

Comfort at High Atmospheric Temperatures

It has been shown that for ordinary temperatures the dry kata cooling power is a reliable index. At high temperatures, however, when profuse sweating occurs, it is clear that the measure of comfort must take count of the drying power of the air. Various opinions have been given as to what constitutes the best index.

Cadman (2, Appendix VIII.) is of the opinion that the individual susceptibility to temperature depends on the wet bulb temperature, no matter what the dry bulb registers.

Bruce (26) concludes that any attempt to judge atmospheric conditions by means of the wet bulb alone is certainly misleading, and considers that the dew point gives a more reliable indication of comfortable conditions than either the dry bulb or the wet bulb alone. He fixes the comfortable limit of the dew point for factories at 62°F. When the dew point is from 70° to 75° Bruce considers that the conditions become very trying, but with a dew point of 62°, even with high dry and wet bulb temperatures, work can be carried on without inconvenience.

Osborne (27) expresses the opinion that to estimate one's state of discomfort in hot weather with any approach to exactness is impossible, but he takes a wet bulb temperature of 73°F. as an empiric standard above which truly tropical feelings arise.

The foregoing conclusions relate to conditions of comfort at high temperatures. Haldane (28) (2) has devoted considerable attention to the maximum temperature which can be borne for some hours without the development of symptoms such as heat stroke. He concludes that the maximum depends on the wet bulb temperature, and that neither the dry bulb temperature nor the degree of humidity matters of itself. In subjects who were stripped to the waist he found that the endurable limit of wet bulb temperature was 88°F. when resting, and about 78°F. when ascending steps at the rate of 14 feet per minute. In a current of air at a velocity of about 150 feet per minute, the endurable limits were raised to 93°F. and 85°F., respectively.

In a series of experiments on himself, in which he climbed steps at the rate of 13½ feet per minute, Vernon (29) found the average endurable limit of wet bulb temperature to be:

	°F.
With no clothing.....	85.8
With light clothing.....	80.9
With moderate clothing.....	80.1

An important factor which Vernon demonstrated is that of acclimatization. In his final experiments the endurable limit of wet bulb temperature was 6°F. higher than in the experiments made a month earlier.

Vernon also adduces evidence of acclimatization to high temperatures from Sutton's (30) experiments. Sutton determined the effect of high wet bulb temperatures on his respiratory exchange, as well as upon his body temperature, and he found that a rise of rectal temperature to 103.2°F. might nearly double his oxygen consumption. Of his six recorded experiments only three were closely comparable. In these approximately the same rise of body temperature caused a 98 per cent. increase in oxygen consumption in the first experiment, a 70 per cent. increase in the second, and only a 55 per cent. increase in the third.

While investigating the working capacity of coal miners, Vernon, Bedford, and Warner (31) systematically noted down their own sensations of freshness. These sensations corresponded better with the effective temperature than with the wet kata cooling power. They also corresponded well with the dry kata cooling power. It must be remembered that the investigators were doing no muscular work to speak of, and were not perspiring freely as were the colliers. The effective temperature and dry kata cooling power were, therefore, good indexes of comfort.

Effect of Clothing

It is a matter of common knowledge that the nature of clothing worn has an important bearing on comfort. We all adapt ourselves in some degree to the atmospheric conditions to which we are exposed. Hill (32, Part II, p. 226), quoting Rubner, points out that a naked man loses heat by radiation three times as quickly as a fully clothed man.

Vernon (33) has determined the rate of cooling of his own body from 99.3° to 98.8°, when clothed to different extents, and exposed to different temperatures, and in still and moving air. His results are shown graphically in Figure 1. These curves demonstrate very clearly the marked influence of the clothing worn. For instance, in still air at a temperature of 63.8° to

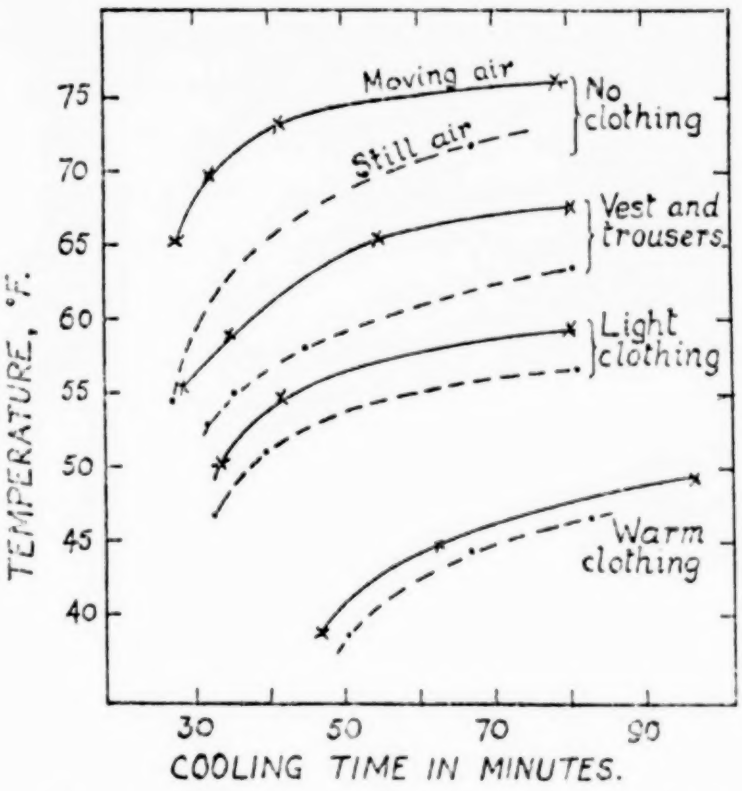

FIG. 1.—Rate of cooling of human body in relation to air temperature and clothing (Vernon (33)).

63.5° the naked body required only 37.8 minutes to cool from 99.3° to 98.8°, while when a vest and trousers were worn it took 80.4 minutes.

Again, the curves show the diminishing effect of air movement in cooling a body as more clothing is worn. In the two upper pairs of curves the components are some distance apart, whereas in the two lower pairs they are much nearer together. In fact, Vernon calculates that the effect of an air current of 100 feet per minute is equivalent to a lowering of temperature of 2° to 4° for the naked or lightly clothed body, while for a warmly clothed body it corresponds with a lowering of only 1°. Hence the con-

clusion is drawn that, in order to induce an actual cooling of the overheated body of a man engaged in hot and heavy work, it is most important to reduce the temperature and next in importance to reduce the clothing, while an increase of air velocity has but little effect.

Vernon (34) (35) directs attention to the clothing worn in hot and heavy occupations in the tin plate and in the iron and steel trades. Instead of the heavy trousers and pants usually worn, he suggests light flannel trousers, and he also maintains that, if facilities were provided at the works for changing clothing already saturated with perspiration, there would be far less prevalence of muscular rheumatism, a complaint to which many workers of this kind are especially liable.

In referring to the clothing worn by weavers in humid cotton sheds, Wyatt (36) points out that the men weavers are more appropriately clothed than the women, and suggests for the latter light clothing permeable to air, such as loose cotton garments, together with a thicker and warmer garment for use on leaving. Physiologic support is given to this view by the results of an investigation into the body temperatures of weavers undertaken by Legge (37, Minutes of Evidence, p. 15 ff.). The body temperatures of women weavers were found to be consistently higher than those of men weavers, and the difference is ascribed to differences in the clothing worn.

Some Physiologic Effects of High Atmospheric Temperatures

The body regulates its temperature by varying (*a*) the quantity of heat given off, and (*b*) the quantity of moisture evaporated from the skin. If the atmosphere is hot and dry, much sweat is poured out and evaporated, with consequent cooling effect. Thus a person may be exposed to temperatures higher than that of his body, in dry air, without rise of body temperature taking place. If the air is hot and moist, it becomes more difficult for the body to rid itself of surplus heat, and beyond certain limits the body temperature begins to rise.

In his evidence before the Departmental Committee on Humidity and Ventilation in Cotton Weaving Sheds (2, Minutes of Evidence, Appendix III.), Haldane said that with a wet bulb temperature exceeding 88° to 90° in fairly still air the body temperature begins to rise, even in the case of persons stripped to the waist and doing no work. In the case of persons doing muscular work, the rise of the body temperature is much more rapid and begins at a much lower wet bulb temperature. It will, for instance, begin (in persons stripped to the waist) at a wet bulb temperature of about 80° in still air with moderately hard muscular work, so that hard and continuous work is impracticable at wet bulb temperatures of over 80° in still air.

Mavrogordato and Pirow (38) report four deaths, presumably from heat stroke, of native "boys" working in a South African mine. The wet kata cooling powers varied from 7.4 to 4.5. All the victims were working for the first or second time in hot places, and their sudden collapse must have been partly due to lack of acclimatization.

The foregoing data refer to extreme conditions. The effects of actual working conditions in linen weaving

sheds are given by Legge (39). From Figure 2 it is clear that after exposure to wet bulb temperatures of over 75° there is a definite rise of mouth temperature. The rise is more marked in women than in men.

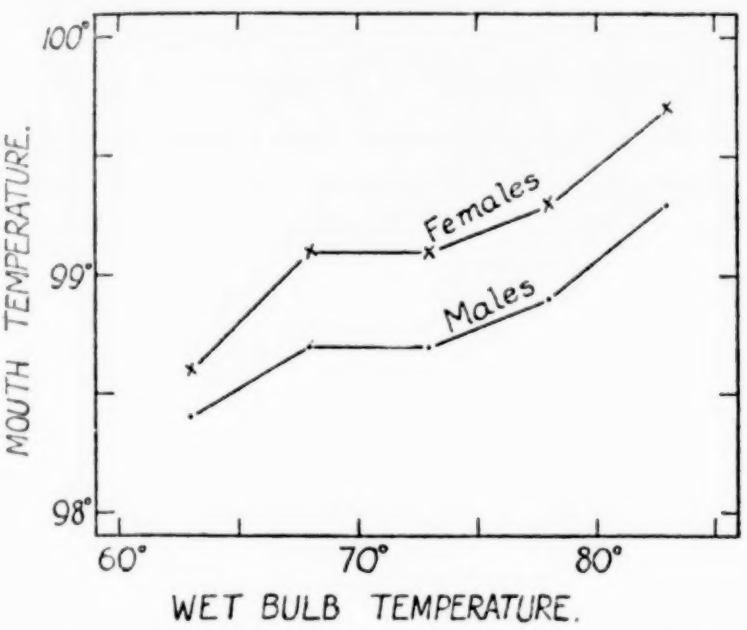

FIG. 2.—Mouth temperatures of linen weavers (Legge (39)).

The higher mouth temperatures in women are ascribed to two causes by Pembrey and Collis in their "Report upon the Physiological Condition of Weavers Working in Warm Humid Atmospheres" (37, Minutes of Evidence, p. 24): (1) less power of accommodation; and (2) less loss of heat, owing to their clothing not being so loose and open as that of men. These observers found that the influence of a warm moist atmosphere is to diminish the difference between the internal temperature of the body and that of the peripheral parts. The tendency is to establish a more uniform temperature of the body as a whole, and to throw a tax upon the powers of accommodation, which is indicated by the low blood pressure, notwithstanding the rapid rate of the pulse. A comparison is given of the blood pressure of weavers at different age periods with that of men at corresponding age periods engaged in the tin plate trade and in grinding metals. The cotton weavers were exposed to a temperature of 70° or over, and the other workers to a wet bulb temperature of less than 60°. The average blood pressures recorded for the tin plate workers and grinders were, respectively, 157 and 152 mm. Hg, while the average for male weavers at the same age periods was only 99 mm.

The New York State Commission on Ventilation (4, p. 51) found that even at ordinary temperatures the body temperature fluctuates with the atmospheric temperature. Observations were made on a number of young men in the period from June to March. Their rectal temperatures were recorded at 8 A.M. on their arrival at the laboratory, and the average temperature of the city for the night, from 9 P.M. to 8 A.M., was obtained. Figure 3 shows that in the summer observations there is fair correspondence be-

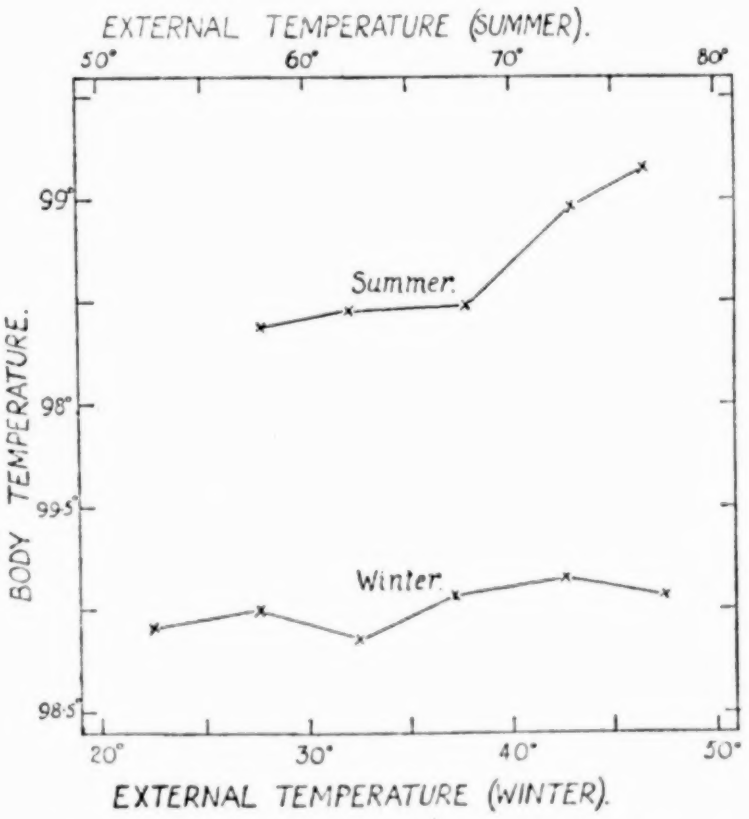

FIG. 3.—Body temperature in relation to external temperature (New York State Commission on Ventilation (4)).

tween outdoor temperatures and body temperature, but in the cold weather there is little, if any, correspondence. It is pointed out that in the winter months people are more warmly clad, they have heavy night covering, and dwell in heated houses, so that they are artificially protected from external conditions; whereas in summer they wear thin clothing both day and night, and are more exposed to normal outdoor temperature.

Yaglou (25) adduces data showing close correspondence of rectal temperature and pulse frequency with effective temperature.

Atmospheric Conditions and their Effects on Efficiency

Influence on Working Capacity

A considerable body of evidence showing the effects of atmospheric conditions on working capacity has been accumulated. The New York State Commission on Ventilation (4, p. 87) studied the effect of different temperatures on the capacity for physical work of a group of four subjects. The conditions of 68° and 75°, both with 50 per cent. relative humidity, were employed. On certain days fresh air at the rate of 45 cubic feet per minute per person was supplied, while on other days the air in the room was not thus renewed. Thus there were four combinations of conditions. The work consisted in periodically lifting a 5-pound iron dumb-bell through a distance of $2\frac{1}{4}$ feet, each lift being recorded by an automatic counter. Work was performed for an hour in the morning and an hour in the afternoon of each day.

From the data given in Table 4 it may be seen that the amount of work done in a stagnant atmosphere at 75° was 23 per cent. less than that done in a fresh atmosphere at 68°. Grouping fresh and stagnant conditions together for the same temperature, an increase in temperature from 68° to 75° caused a reduction of 15 per cent. in work done. When the results for fresh and stagnant conditions are compared it is found that the reduction in a stagnant as compared with a fresh atmosphere was 9 per cent. This effect is probably due to a lower cooling power. The entry of the fresh air into the room would undoubtedly cause greater air movement, and thus, with the same temperature, the cooling power would be increased.

Hill and Campbell (40) made observations of another kind. A trained laboratory assistant, clad in ordinary clothing, worked a bicycle ergometer at a steady rate, for periods of fifteen minutes, under varying atmospheric conditions, and observations of pulse rate were made. While it is generally claimed that pulse rate varies directly with work done, Hill and Campbell found that this was so only when the cooling power was kept constant. Their principal conclusion was "that cool conditions have great advantage over warm conditions, mainly because the heart has less work to do and bodily comfort is maintained when the cooling power is high."

Yaglou (25) mentions that between effective temperatures of 40° and 75° the amount of work performed was practically constant. Above 75° the output fell off gradually until 80° was exceeded, and then the fall became very rapid. The output at an effective temperature of 93° was only one-half that at 70°.

In the Rand mines, Orenstein and Ireland (18) investigated the working capacity of natives under different conditions. Their method was to put a native boy to work on a rotary ergometer for four hours daily, in working places at various depths, while another boy was tested with a hammer dynamometer. The cooling power of the air was determined on each occasion, and temperatures as high as 88° dry bulb and 87° wet bulb were experienced. It was found that, if the efficiency of the workers at a dry kata cooling power of 6 be taken as 100, their efficiency at cooling powers of 5, 4, 3, 2, and 1 is 90, 80, 70, 60, and 50, respectively. The corresponding wet kata cooling powers were found to be 16, 13.6, 11.2, 8.8, 6.4, and 4. It was estimated that in a certain mine the total loss of efficiency through deficient cooling power was 21 per cent. It was also found that a small fan with a capacity of about 2,000 cubic feet of air per minute operated about 10 to 20 feet from the workers may increase the output (under experimental conditions) by as much as 46 per cent.

Again, T. D. Jones (41) states, though without giving any exact data, that the coal miners working in a district in a South Wales colliery where the temperature was 83° dry bulb and 81.5° wet bulb produced only about 40 per cent. of the output of men working under more favorable temperature conditions.

In England, Vernon, Bedford, and Warner (31) have investigated the relation of atmospheric conditions to the working capacity of coal miners. Owing to the great differences which exist between different working places with regard to the difficulty of hewing coal, it was found impossible to test the men's efficiency by measuring their output. Instead, two other tests were used, *viz.*, a rest pause test and a tub filling time test.

Systematic observations were made on 138 colliers in working places rang-

TABLE 4.—RELATIVE AMOUNT OF PHYSICAL WORK PERFORMED UNDER VARIOUS ATMOSPHERIC CONDITIONS

ATMOSPHERIC CONDITIONS	RELATIVE AMOUNT OF WORK DONE PER HOUR[1]			PERCENTAGE COMPARISONS
	Morning	Afternoon	Whole Day	
68°, fresh	119	81	100	100
68°, stagnant	107	75	91	91
75°, fresh	105	65	85	100
75°, stagnant	93	60	77	90
68°, fresh and stagnant	113	78	96	100
75°, fresh and stagnant	99	63	81	85
68° and 75°, fresh	112	73	93	100
68° and 75°, stagnant	100	68	84	91

[1] Average for 68°F. (fresh) taken as 100.

ing in depth from about 540 feet to 2,715 feet. Every cessation from work was noted down to the nearest quarter minute, and the time taken in filling tubs (or trams) was also noted. With decrease of wet kata cooling power the voluntary rests from work rose fairly steadily from $4\frac{1}{2}$ minutes per hour to 8 minutes per hour, while the total involuntary rests rose from about 2 to 3 minutes to over 14 minutes. The total rests ranged from a minimum of about 7 minutes per hour at cooling powers of 14 to 19 to a maximum of about $22\frac{1}{2}$ minutes at cooling powers of 5 to 7. In addition, the speed of work differed quite appreciably. The men took 8 minutes to fill a 10-hundredweight tub under the most favorable conditions, as compared with 9.6 minutes when conditions were least favorable. The working capacity of the men was calculated on the assumption that the general rate of working varied directly as the rate of filling tubs. From Figure 4 it can be seen that under the most adverse conditions the working capacity was only 59 per cent. as great as under the most favorable conditions.

The fact that the wet kata cooling power is a good index of atmospheric conditions in relation to working capacity implies that air movement has an important influence. That this is so was shown when the data were split up according to the wet kata cooling power and subdivided according as the air velocity was under or over 25 feet per minute. When the rate of production for the high air velocity observations (mean velocity = 51 feet per minute) was taken as 100, that for the low air velocity group, with a mean velocity of only 15 feet per minute, was only 92, even though the wet kata cooling power in both groups was the same. From this it is evident that the wet kata cooling power did not make enough allowance for air movement. It was, however, far more accurate than any other available index.

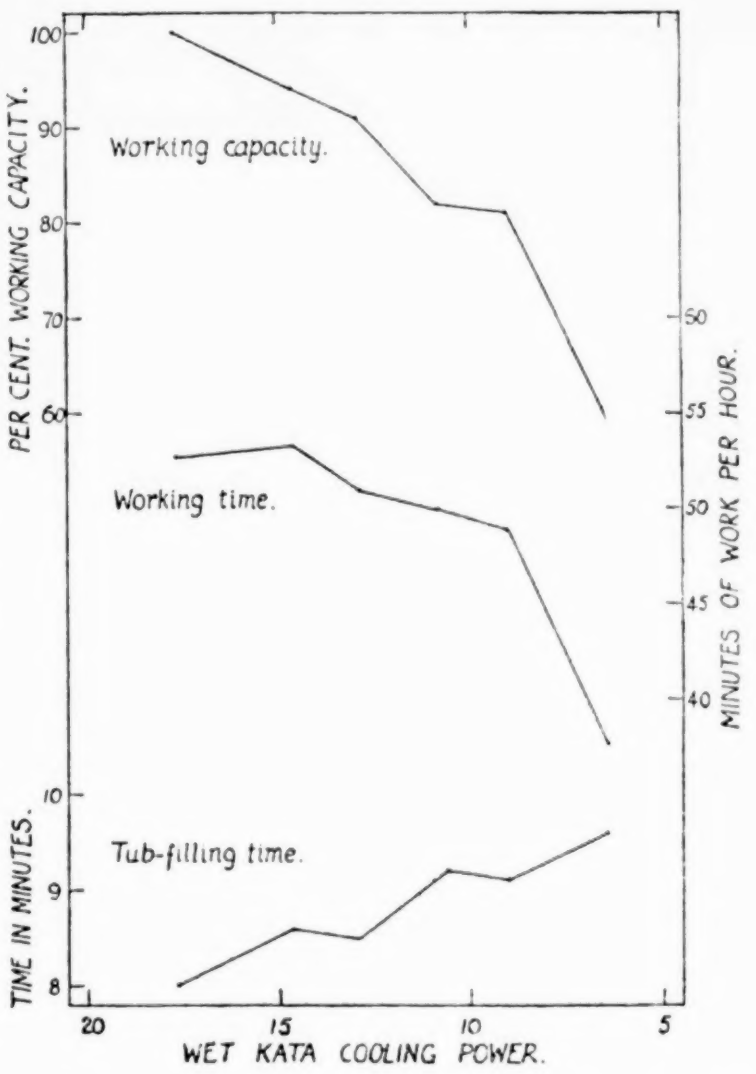

FIG. 4.—Working capacity of coal miners (Vernon, Bedford, and Warner (31)).

As the result of observations in various heavy industries (42), it was found that the men invariably take short rests from work every few minutes, and the more arduous the work the longer and more frequent are the rests.

In heavy work, especially when it involves exposure to high temperature, output undergoes a consistent seasonal variation, being, with very few exceptions, greatest in winter, least in summer, and intermediate between the

two in spring and in autumn. In Table 5 are summarized data obtained by Vernon (34) (35) and by Farmer, Brooke, and Chambers (43).

from Figure 5. Vernon has brought out this point more clearly by grouping the weekly output data of five tin plate factories according to the mean

TABLE 5.—SEASONAL CHANGES OF OUTPUT IN HEAVY WORK

OCCUPATION	RELATIVE OUTPUT DURING		
	Winter (Dec.–March)	Spring and Autumn	Summer (June–Sept.)
Men charging blast furnaces	105.0	106.5	88.5
Open hearth steel melters at works C	107.7	102.0	96.2
Open hearth steel melters at works D	85.7	85.1	84.8
Open hearth steel melters at works F	102.5	100.5	97.2
Open hearth steel melters at works J	102.5	104.6	102.8
Rolling mill men at works III	107.0	106.5	107.0
Rolling mill men at works V	124.0	118.0	111.0
Rolling mill men at works VI	105.2	98.4	96.5
Men puddling wrought iron	104.7	102.2	96.0
Tin plate millmen	103.3	99.9	96.9
Mean temperature at Greenwich (°F.)	40.0	48.5	60.2
Glass bottle making	101.7	99.6	98.7

These data by no means demonstrate the full amount of variation in output due to fluctuations of temperature. In each of the four-month periods a considerable variation in temperature occurs, with corresponding effects on output, as will be seen

weekly temperatures as recorded in the district. These factories differed greatly in the efficiency of their ventilation, and in Figure 6 the influence of the ventilation is strikingly shown. At factory A, where the ventilation was good, the fluctuation

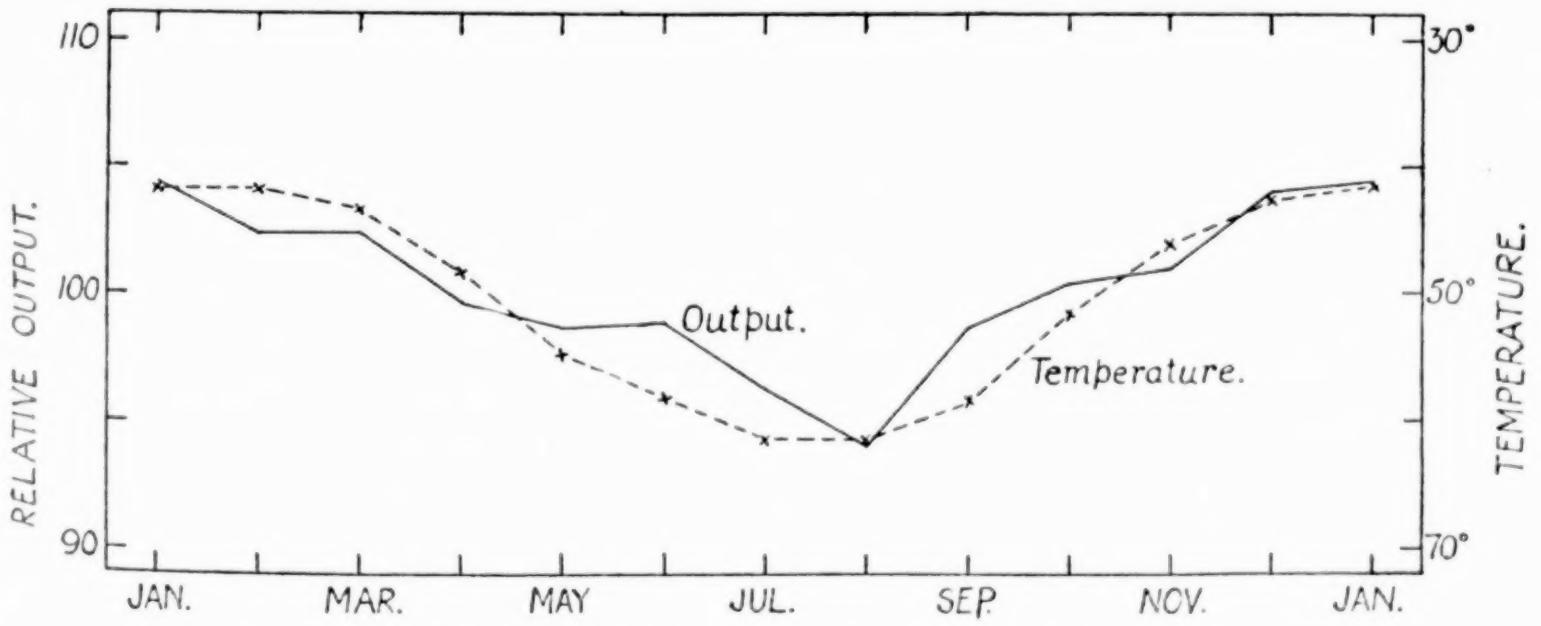

FIG. 5.—Seasonal variation of output of tin plate workers (Vernon (34)).

of output with temperature was small; whereas at factory E, with no artificial and but poor natural ventilation, it was very marked. The moderately ventilated factories gave intermediate results.

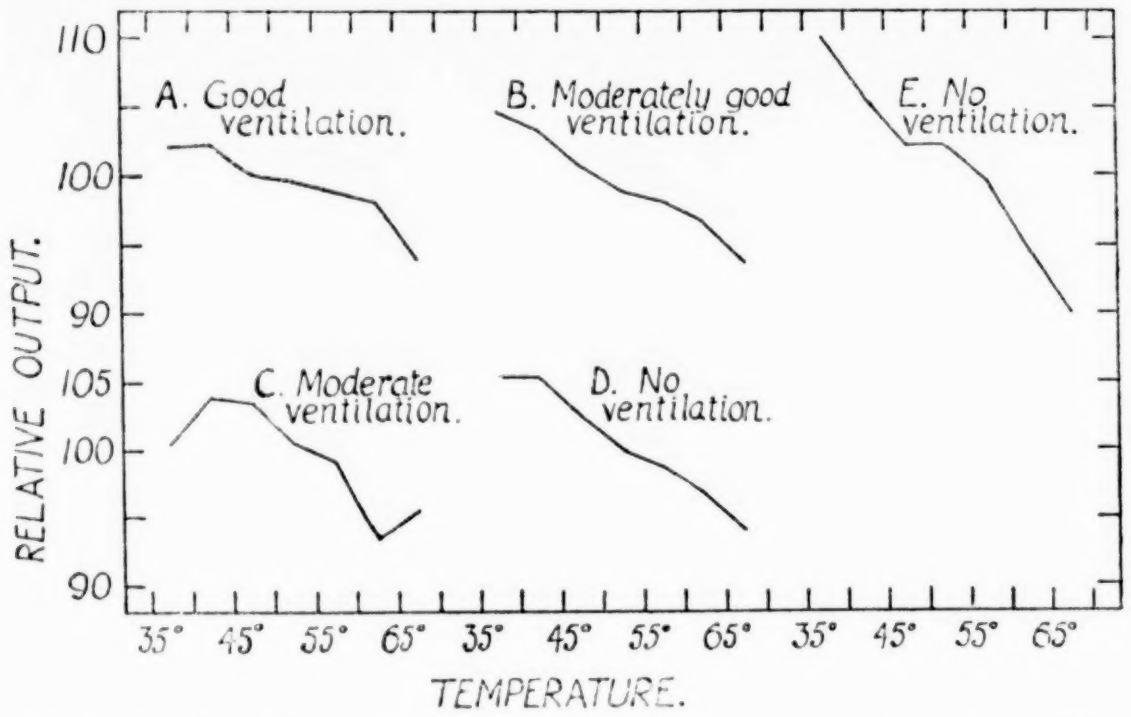

FIG. 6.—Output in tin plate manufacture in relation to temperature (Vernon (34)).

Even these data do not express the full effect of temperature, since in each week there are considerable variations in temperature from day to day and from shift to shift. Vernon estimates that in factory E the output of the shifts during the hottest weather was probably 30 per cent. less than during the coldest weather.

Huntington (44) adduces data showing the seasonal variation of a composite group of men and women operatives in America. The maximum efficiency was reached with a mean outdoor temperature of 59°F.

Influence on Working of Materials

It is commonly known that certain materials require special temperature conditions for their manipulation. In some cases it is possible to fulfil these requirements by local methods, without much influencing the general room temperature; in other cases the whole room must be kept at the required temperature. In the weaving of certain qualities of linen and cotton goods it is the general custom to carry on the work in artificially humidified air at a high temperature.

The Departmental Committee on Humidity and Ventilation in Flax Mills and Linen Factories (39) describes the results of certain tests carried out in weaving factories to show the effects of different degrees of humidity on weaving.

One series of tests was made on the weaving of fine cambrics. In addition to observations of temperature and humidity, the number of warp breakages in unit length of cloth woven and the time occupied in weaving unit length were determined (see Table 6). A decrease in wet bulb temperature, or an increase in the difference between dry and wet bulb temperature, causes an increase in the number of warp breakages and in the time occupied in weaving unit length

of cloth. A less degree of humidity than that corresponding to a difference of 2° between dry and wet bulb temperatures has a markedly detrimental effect.

the efficiency was respectively 3.3, 1.8, and 1.6 per cent. less than in the morning when the temperature averaged 68.9°, 69°, and 69.3°. It was concluded that when the wet bulb

TABLE 6.—INFLUENCE OF TEMPERATURE AND HUMIDITY ON WARP BREAKAGES AND SPEED OF PRODUCTION IN LINEN WEAVING

ON BASIS OF TEMPERATURE				ON BASIS OF DIFFERENCE BETWEEN DRY AND WET BULB TEMPERATURES			
Wet Bulb Temperature	Difference between Dry and Wet Bulb Temperatures	Warp Breakages	Time Occupied	Wet Bulb Temperature	Difference between Dry and Wet Bulb Temperatures	Warp Breakages	Time Occupied
°F.	°F.			°F.	°F.		
61.6	1.5	11.3	52.0	66.0	1.1	6.3	47.5
64.0	1.7	11.1	54.0	66.0	1.4	7.4	45.4
65.7	1.5	7.3	47.6	67.0	1.6	6.8	46.1
68.5	1.6	7.6	46.0	64.6	1.7	9.8	50.2
72.0	1.7	6.3	42.0	68.0	2.2	13.3	60.0

In more recent work in connection with linen weaving, Weston (45) also observed the increased output with higher wet bulb temperatures. He found strongly significant positive correlations between wet bulb temperature and efficiency, where "efficiency" represents the percentage achieved of the number of movements or "picks" which could have been made by a nonstop loom.

As a rule the higher temperatures which obtained during the afternoon spells were associated with higher efficiency than was observed in the morning. However, this was true only within certain limits, for it was found that, when unusually high wet bulb temperatures prevailed, the efficiency began to fall. Thus, in one shed, the wet bulb temperature in the afternoons of three consecutive days averaged 74.1°, 75.6°, and 74.8°, and

temperature exceeds about 73° the adverse physiologic effect more than counterbalances the favorable physical conditions for weaving.

Observations on efficiency in cotton weaving show somewhat similar results to those found in linen factories. Wyatt (46) records a mean correlation of +0.557 between dry bulb temperature and the output of weavers in a humid cotton shed. There was also a small but persistent partial correlation between output and relative humidity (dry bulb temperature constant), which indicated that output in this shed tended to rise with increasing humidity. In another shed with a temperature of 77° and a relative humidity of 85 per cent., the warp breakages were few. With the same temperature but a relative humidity of 63 per cent., the weavers complained of the cloth weaving badly. In the

former case the efficiency was 76.5 per cent., but in the latter it was only 68.9 per cent. In a dry shed, however, where other kinds of cloth were woven, the variations in temperature and humidity observed appear to have had very little effect on output.

As in the case of linen factories, it was shown that excessively high temperatures are harmful. When the average temperature for the afternoon spell was comparatively low, the efficiency in humid sheds tended to remain at a fairly uniform level throughout the spell. When the average temperature was high, the efficiency decreased as the afternoon advanced. The greater decrease in efficiency under the conditions of higher temperature is due to the effects of the atmospheric conditions on the weaver, since breakages tend to decrease at higher temperatures. Wyatt holds that, if maximum efficiency is to be maintained, the warp must be placed in a different atmosphere from that which surrounds the weaver. Under existing regulations, he states, the best conditions for productive efficiency in weaving appear to be obtained with a dry bulb temperature of from 70° to 75°F., and a relative humidity of from 80 to 85 per cent. When the temperature exceeds about 75°, the adverse physiologic effects are reflected in the output.

In a later report Wyatt (47) produces further evidence of reduced efficiency at temperatures over 75°. Both stoppages and breakages diminish as the temperature rises with humidity constant, and when humidity rises with temperature constant, yet the output drops when the temperature exceeds 75°, or when the humidity (at temperatures of 75° to 80°) exceeds 82.5 per cent.

In a study of silk weaving, Elton (48) found a slight increase in output with increasing temperature. The range of temperature covered was only from 55° to 65°, and it can hardly be assumed that definite harmful effects would accrue at a temperature of 65°. It is quite probable that the moderate increase in temperature had a beneficial physical effect on the weaving. Elton found no relationship between humidity and output.

Atmospheric Conditions in Relation to Accident Frequency

The first recorded observations of the influence of atmospheric conditions on accident frequency appear to be those made by Vernon (49). At a large munitions factory (factory A) the average temperature during each work spell was obtained by the use of thermographs, and the number of cuts reported in each spell recorded.

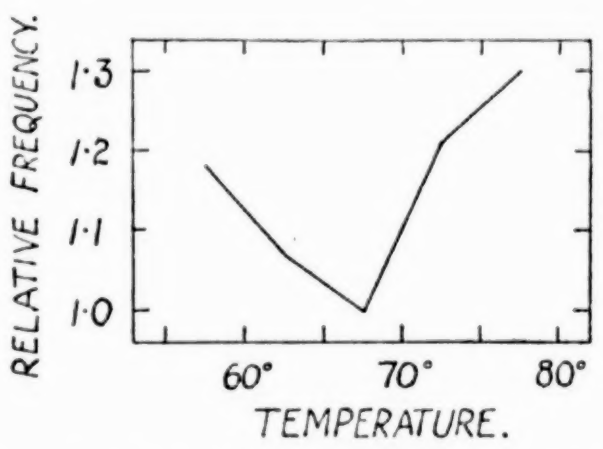

Fig. 7.—Relative frequency of accidents in relation to shop temperature (Vernon (49)).

In Figure 7 the relative frequency of accidents (average of all spells) is shown in relation to the shop temperature. The number of accidents at a temperature of 65° to 69° is taken as

unity. It is clear that accidents are at a minimum at temperatures of from 65° to 69°F. At lower temperatures a considerable rise was recorded, *viz.*, 7 per cent. at from 60° to 64°, and 18 per cent. at 59° or less. At temperatures above 69° the rise is much sharper.

Later, Osborne and Vernon (50) extended these observations. Figure 8 shows the relative accident frequency at three factories in relation to shop temperature. There is an irregu-

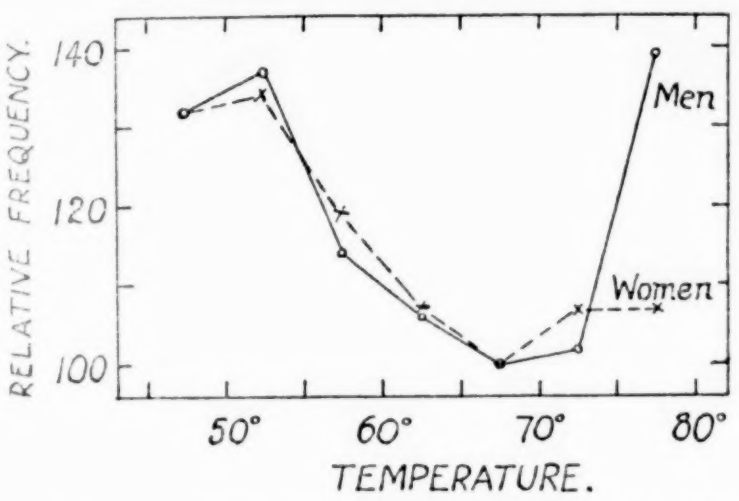

FIG. 8.—Relative frequency of accidents in relation to shop temperature (Osborne and Vernon (50)).

larity in the fall in accident frequency at temperatures below 50°, and it is pointed out that this may be an error "due to insufficiency in the number of records, or it may be due to the workers reducing their rate of production, and thereby their liability to accidents, in very cold weather." The optimum temperature for accident prevention in engineering shops appears to be about 67°.

There is also evidence showing that accidents among miners are influenced by the atmospheric conditions under which the men work. Davies (51) found that when a cooling plant was introduced at the Morro Velho Mine in Brazil, by means of which the intake air was cooled from about 67° down to 43°, the wet bulb temperature in the deepest workings—some 6,000 feet below the surface—was reduced from 89° to 80°. In the sixteen months previous to the installation of the plant there were twenty fatal accidents, and in the sixteen months after its introduction only six.

In coal mines, Vernon, Bedford, and Warner (31) studied the accident records at two collieries. They ascertained the accident rate in two seams at one colliery, while at the other they obtained separate data for the upper and lower portions of one seam and for another seam. Observations of temperature and of cooling power were made so as to get a fair idea of the average atmospheric conditions at the coal face in each of the seams. The results obtained suggested that the miners working in the hotter seams were more liable to accidents than were those exposed to less trying conditions.

In a further study the same investigators (52) recorded the accidents incurred by about 18,000 coal miners over a period of two years. These men were employed at ten different collieries in which from one to three seams were worked. Taking each seam at one colliery as a unit there were seventeen seams. Numerous observations were made of the atmospheric conditions in each of the seams, and from these were determined the average conditions to which each group of men were exposed.

High temperatures were found to have a marked influence on the frequency of accidents. The accidents to all men exposed to a given range of

temperature were grouped together and accident frequency rates were then calculated for these groups. The accident frequency at the highest temperatures was from 70 to 76 per cent. greater than at the lowest temperatures (see Table 7).

TABLE 7.—ACCIDENT FREQUENCY RATE OF COAL MINERS (ALL CAUSES) IN RELATION TO DRY BULB TEMPERATURE

COAL FACE WORKERS			OTHER UNDERGROUND WORKERS		
Range of Temperature	Mean Temperature	Accidents per 100,000 Man Shifts	Range of Temperature	Mean Temperature	Accidents per 100,000 Man Shifts
°F.	°F.		°F.	°F.	
Under 70	64.4	78	Under 70	62.6	43
70–79	77.3	105	70–74	72.3	62
80 and over	82.1	137	75 and over	77.0	73

The accidents were subdivided according as they caused absences of under 10 days, 10 to 19 days, 20 to 59 days, or 60 days or over. When frequency rates were calculated for these different periods of disability it was found that the severe accidents remained practically steady at all temperatures. The increase in accidents at high temperatures was entirely due to the increase in the number of the less severe accidents, mainly to those involving disability of under 10 days. The relative accident frequencies are shown in Figure 9. In each case the accident frequency at temperatures below 70° has been taken as the standard. It is suggested that the much more frequent absences for short periods in the hotter seams are not due to a greater liability to accident, but rather to a desire to obtain temporary relief from the trying conditions of work. Probably men working under these exacting conditions stay off work for injuries which, in cooler pits, would not cause them to absent themselves from work for more than a day or two.

Atmospheric Conditions and Health

The influence of atmospheric conditions on efficiency and on liability to accidents has been indicated. It remains to adduce data showing their influence on health.

Vernon, Bedford, and Warner (15) made observations in six workrooms at a canister factory, where about 140 women and girls were working in each room, or 809 altogether. Regular records of the time lost from sickness, as distinct from that lost through other causes, were obtained for a period of two years.

In Table 8 it is shown that on an average the time lost varied from 1.47 per cent. of working time in room *a* to 2.05 per cent. in room *f*. The time lost appeared to depend more on the temperature of the air in the various rooms than on its cooling power. The temperature in room *f* where tin plates were printed averaged about 7° higher

than in workrooms *a* to *d*, and the sickness was 32 per cent. in excess of the average for those rooms. Room *e*, which in winter was 7° colder than the average, had a sickness rate 21 per cent. in excess.

children in the fan ventilated rooms at 68° differed distinctly. They showed 18 per cent. more absences from sickness, while the children in attendance showed 70 per cent. more illness. This considerable excess was not due

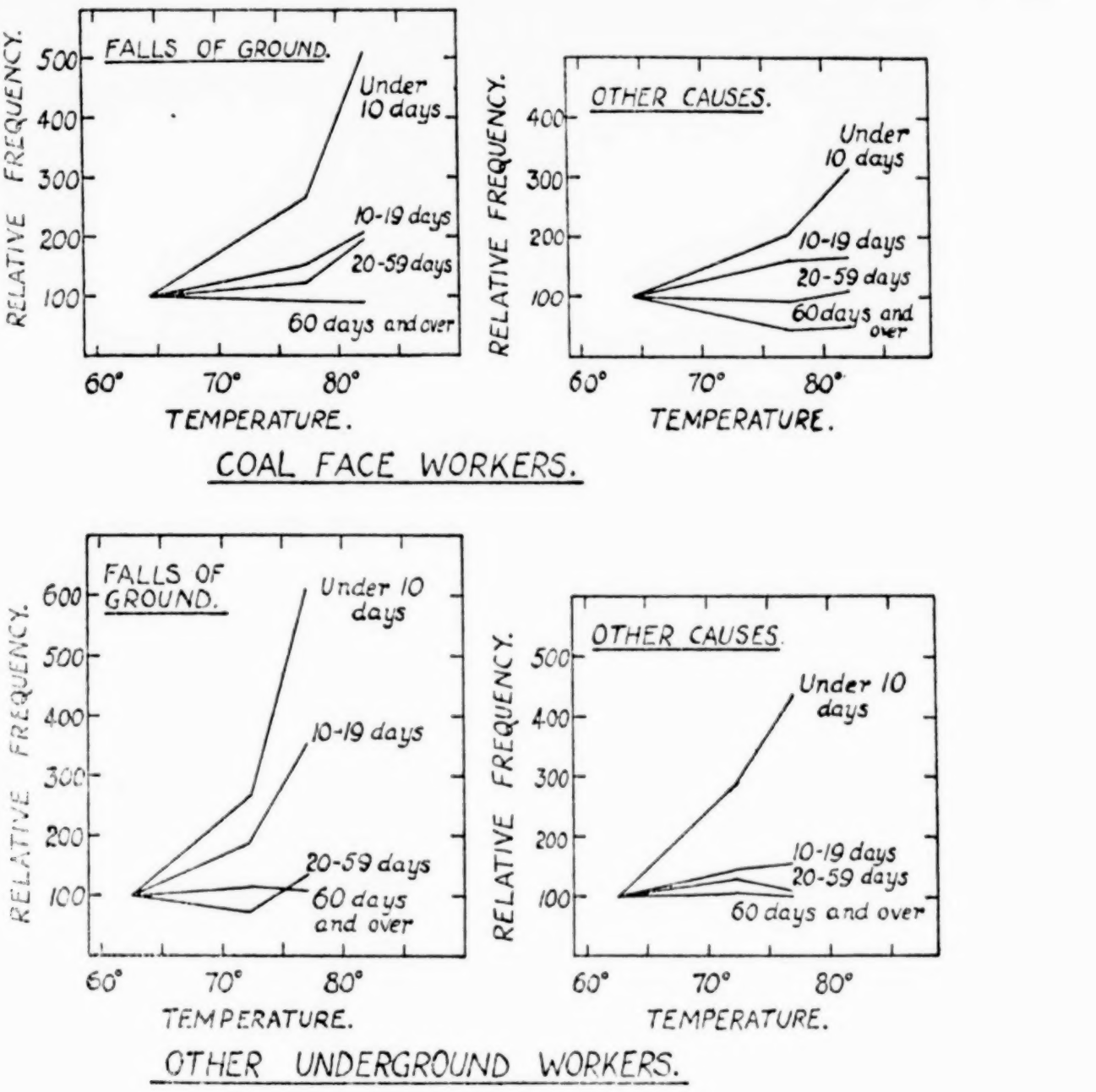

FIG. 9.—Accident disability of coal miners in relation to temperature (Vernon, Bedford, and Warner (52)).

The New York State Commission on Ventilation investigated the health of children in New York schools. It was found (4, p. 527) that while the children in the window ventilated classrooms at a temperature of 59°F. did not differ materially in respect to respiratory illness from those in the window ventilated rooms at 66°, to overcrowding, for the fan ventilated rooms were less congested than the window ventilated. The Commissioners think that the excess of sickness was due chiefly to the higher temperature, though they ascribe some importance to the greater uniformity of temperature and of air flow characteristic of the fan ventilated rooms.

Again, the causes of absenteeism in fifteen public schools in Washington were studied by Louise Tayler-Jones (53). She found that while 445 children, aged 8 years, in fourteen schools with ordinary ventilation lost, on an average, from 1.1 to 4.5 days per year from colds, the thirty-five children attending the single open window school studied lost only 0.6 day from this cause. Absenteeism from causes other than colds was almost the same in both classes of school. These data and the New York data agree with those obtained by Vernon, Bedford, and Warner in indicating that the human organism is very susceptible even to moderate changes of heating and ventilation.

The New York State Commission (4, p. 160) found that workers subjected for long periods to high temperature and high humidity, such as laundry workers, exhibit an atrophic rhinitis in an abnormally high percentage of cases. Workers exposed to drier heat, as in boiler rooms, also suffer, but less than the group in moist heat.

Vernon and Rusher (35, p. 78) investigated the sickness of steel workers over the period 1913 to 1918. The steel melters experienced 23 per cent. more sickness than the average for all steel workers, the puddlers 20 per cent. more, and the tin plate millmen 12 per cent. more. On the other hand, the enginemen and general workers experienced 8 or 9 per cent. less than the average. It is pointed out that these latter groups of men, for the most part, work under ordinary conditions of temperature, while the others work under trying conditions of high temperature. The excess of sickness experienced by the puddlers is due entirely to rheumatism and respiratory diseases, and it is suggested that this excess is due to the custom followed by many puddlers of alternating periods of extremely hard work, of about twenty minutes' duration, with similar periods in which they rest or do light work. Thereby they incur great risk of chills. The same applies to steel melters and pitmen in less degree. Tin plate millmen did not lose any more time from rheumatism

TABLE 8.—TIME LOST THROUGH SICKNESS AMONG 809 WOMEN EMPLOYED AT A CANISTER FACTORY

WORK-ROOM	MEAN WORKROOM TEMPERATURE		MEAN AIR VELOCITY		MEAN COOLING POWER		TIME LOST BY SICKNESS	
	Winter	Summer	Winter	Summer	Winter	Summer		
	°F.	*°F.*	*ft./min.*	*ft./min.*			*%*	
a	59.8	66.2	40	47	7.9	6.6	1.47	
b	63.0	67.2	32	37	6.8	6.0	1.51	1.55
c	61.3	71.7	25	38	6.8	5.2	1.60	
d	62.5	68.7	21	28	6.3	5.5	1.64	
	61.7	68.5						
e	54.3	65.9	27	28	8.5	6.0	1.88	
f	67.1	77.9	35	33	6.0	3.7	2.05	
Mean.....	61.3	69.6	30	35	7.0	5.5	1.69	

than did all the workers combined. These men work continuously throughout their shift, seldom taking rests of longer than four minutes' duration (34, p. 12). Such short periods would not, as a rule, be sufficient to cause chills.

In addition to their study of sickness, Vernon and Rusher investigated the mortality of steel workers. Their investigation covered a group of over 20,000 men for six years. Compared with the rates for all occupied and retired males, the steel workers as a whole had a mortality from respiratory diseases 102 per cent. above the average, while that from tuberculosis was 48 per cent. below the average. The puddlers had a mortality rate from respiratory diseases 159 per cent. above the average, the steel melters one of 119 per cent. and the tin plate millmen one of 49 per cent. above the average.

Vernon, Bedford, and Warner (52) have compared the sickness rates of coal miners working under different atmospheric conditions. The sickness rates were calculated by taking shifts lost on account of sickness as a percentage of the possible number of shifts. The variation of sickness with dry bulb temperature is shown in Table 9, where sickness rates have been calculated for all men working at temperatures of under 70°, 70° to 74°, and so on. Similarly, in Table 10 the data have been grouped for men exposed to different air velocities.

TABLE 9.—SICKNESS OF COAL MINERS IN RELATION TO DRY BULB TEMPERATURE

RANGE OF DRY BULB TEMPERATURE	COAL FACE WORKERS		OTHER UNDERGROUND WORKERS	
	Mean Temperature	Shifts Lost on Account of Sickness	Mean Temperature	Shifts Lost on Account of Sickness
°F.	*°F.*	*%*	*°F.*	*%*
Under 70	67.9	3.02	66.7	2.34
70–74	....	....	72.9	3.24
75–79	76.9	4.49	76.5	3.98
80 and over	80.9	4.89	....	....

The men working in the hotter pits tend to lose more time on account of sickness than do those in the cooler pits. Sickness also tends to increase with high air velocities, probably because the men are liable to become chilled if they are compelled to cease work for a time.

In a recent book, Moss (19, p. 182) says: "High air temperatures underground do not cause ill-health, they merely affect the output of work when the wet-bulb thermometer is also high. I have always found that men working in hot mines are equally fit physically, as those working in cold ones." He refers to the men working in two stalls at Pendleton Colliery, Lancashire, where the conditions were:

Dry bulb temperature (°F.)	100.5
Wet bulb temperature (°F.)	86.5
Wet kata cooling power	4.0

These men gave an output in excess of the average for the whole pit. Moss says (19, p. 183): ". . . . the percentage absenteeism of these men indicated quite clearly that the temperature conditions were having no effect upon their health." He then refers to the "fallacy" of attaching any value to dry kata cooling powers, or to anything but extremely low wet kata cooling powers in so far as they relate to mine workers in Great Britain.

These data are based on observations on but few men, and are definitely contradicted by the more extensive work of Vernon, Bedford, and Warner.

Suggestive data were adduced by the United States Bureau of Labor Statistics (54) with regard to the mortality at Fall River, one of the great cotton manufacturing centers of America. Tuberculosis is very prevalent, especially among the spinners. Between the ages of 15 and 45, the males had a death rate of 29 per cent. above the standard, while among the females it was 160 per cent. above. The air in cotton spinning rooms is very hot and humid, and it was suggested by Vernon and Bedford (14) that this factor may be to some extent responsible for the excessive mortality.

Maloney (55) has inquired into the use of artificial humidification in cotton mills in India. He finds no proof that health is always adversely affected, but he does find that the physique of the cotton operatives is lower than that of workers of similar castes and wage earning capacities in other trades. He suggests that a higher cooling power should be required, and suggests a standard of 11 for the wet kata. He also proposes that artificial humidification should cease when the dry bulb temperature is 85°.

Reporting on the physical condition of cotton weavers, Pembrey and Collis (37) say that the general poor physique of these operatives can only be explained by the prolonged exposure to a warm, moist atmosphere, for the same conditions are not observed among workers in other industries in Lancashire. In a study in vocational guidance, Muscio (56) tested over 2,300 youths between the ages of 14 and 18, nearly all of

TABLE 10.—SICKNESS OF COAL MINERS IN RELATION TO AIR VELOCITY

COAL FACE WORKERS			OTHER UNDERGROUND WORKERS		
Range of Velocity	Mean Air Velocity	Shifts Lost on Account of Sickness	Range of Velocity	Mean Air Velocity	Shifts Lost on Account of Sickness
ft./min.	*ft./min.*	*%*	*ft./min.*	*ft./min.*	*%*
Under 30	24	3.67	Under 120	90	2.73
			120–159	137	3.14
30–59	53	4.33	160–199	171	3.11
			200–239	...	....
60–89	74	5.46	240 and over	264	5.04

whom were engineering students or apprentices. About 200 of them were employed in the cement industry. The youths were drawn, 1,500 from industrial Essex, and 800 from Manchester. Muscio found that the Essex youths were definitely superior physically to the Manchester youths. The two groups were as similar as regards social and industrial class as any two groups are ever likely to be, and Muscio claimed that the differences found represent typical differences between the inhabitants of these two parts of the country. The comparison drawn by Pembrey and Collis was between different groups of workers in the same county. It appears, then, that, while the physique of the general industrial population of Lancashire is probably inferior to that of a similar population in certain other localities, the physique of cotton weavers is definitely poorer than that of the industrial workers in Lancashire generally.

A. B. Hill (57) has made an extensive investigation of sickness among cotton weavers, in order to determine the incidence of sickness in a large sample of "humid" and "non-humid" weaving sheds. The inquiry covered 128 separate sheds with a total of over 20,000 weavers. The sickness experienced by these weavers during a complete year was ascertained from the records of the various Approved Societies (acting under the National Health Insurance Acts).

Taking the sickness rates for all ages it was found that in each case the weavers in dry sheds experienced *more* sickness than those in the wet sheds. The males and married females in the dry sheds had each nearly one day per year more sickness than the corresponding groups in the wet sheds, while the other females had a day and a half more sickness. The sickness rates just referred to dealt only with the first twenty-six weeks' sickness. When incapacity in excess of twenty-six weeks' duration was taken into account, the results were much the same. The weavers in dry sheds still compared adversely with those in wet sheds.

It was shown that the number of claims for sickness benefit was approximately the same in the two types of shed, and the slight excess of sickness in the dry sheds arose, therefore, not from any excess of claims, but from longer duration of sickness when contracted. It was further shown that this longer duration of sickness was due to the presence of a few more claims of very long duration in the non-humid sheds, and not to any uniform difference between the two groups.

When the sheds were grouped according to their characteristic dry bulb and wet bulb temperatures and their relative humidities, no increase was shown in the amount of sickness as the temperatures rose or as the humidity became greater. Analysis of the sickness by cause failed to show any consistent differences in the distribution of the specific sickness as between humid and non-humid sheds.

Hill's final conclusion is that no material difference exists between humid and non-humid sheds, either in the amount or in the nature of the sickness suffered.

Conclusion

The data which have been recorded make it abundantly clear that moderate temperature conditions are re-

quired if a maximum of efficiency and of general well-being for the industrial worker is to be insured. Comfort, and therefore probably contentment, is closely related to atmospheric conditions. Absence, on account both of sickness and of accident, is influenced to a large extent by the temperature conditions of the workplace; and efficiency has been shown to be adversely affected by high air temperatures.

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    See also Vernon, H. M., Bedford, T., and Warner, C. G.: The Ventilation and Heating of Factories. This Jour., 1927, *9*, 51.
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FURTHER EXPERIMENTAL OBSERVATIONS TO DETERMINE THE RELATIONS BETWEEN KATA COOLING POWERS AND ATMOSPHERIC CONDITIONS*

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THE kata-thermometer, an instrument designed by Leonard Hill, has now been in use for several years as a measure of ventilation in rooms, factories, and mines. Formulas were worked out by Hargood-Ash and Leonard Hill from observations made in the wind tunnels at the National Physical Laboratory, by means of which the kata-thermometer has been used as an anemometer. As those tunnels could not be heated and humidified at will, observations could not be made at those high temperatures and humidities which are of interest in certain factories and mines. The extension of the use of the formulas to such conditions, which has been made by some mining engineers, was not, then, justifiable. In order to enable mining engineers and others to use the kata-thermometer as an anemometer, and as a means of determining suitable conditions of ventilation for workers, in warm and humid places, a fresh research has been carried out in a wind tunnel set up at the National Institute for Medical Research.

METHOD OF TAKING OBSERVATIONS

The object aimed at when arranging for the experiments was to control and measure the temperature, humidity, and velocity of the air around the kata-thermometer.

Though the wind tunnel used was not of the costly construction necessary to insure perfect streamline air motion, such accuracy being superfluous for its original purpose—the study of physiologic changes under various air conditions—we consider that, with the precautions taken, a high degree of accuracy was obtained.

The tunnel was a rectangular one, 6 feet wide, 7 feet, 11 inches high, and 24 feet long, constructed of duralite panels and wooden framing and set inside an army hut, as shown in Figure 1. At the exit end of the inner tunnel there was fixed a 62-inch Blackman propeller type fan coupled directly to

*The observations described were arranged and taken by Dr. Leonard Hill and Mr. T. C. Angus, and the graduation of the results was done by Miss E. M. Newbold, who is indebted to Mr. E. Lewis-Faning, Mr. J. W. Martin, and Miss C. A. Thomas for help in the arithmetical work involved, and to Miss M. G. Buckle for drawing the graphs. Received for publication March 5, 1928.

a 2.7-kilowatt series-wound motor. This fan drew the air through the tunnel and past the instruments under test, returning it to the inlet end of the tunnel which it reentered through a "honeycomb," designed to eliminate

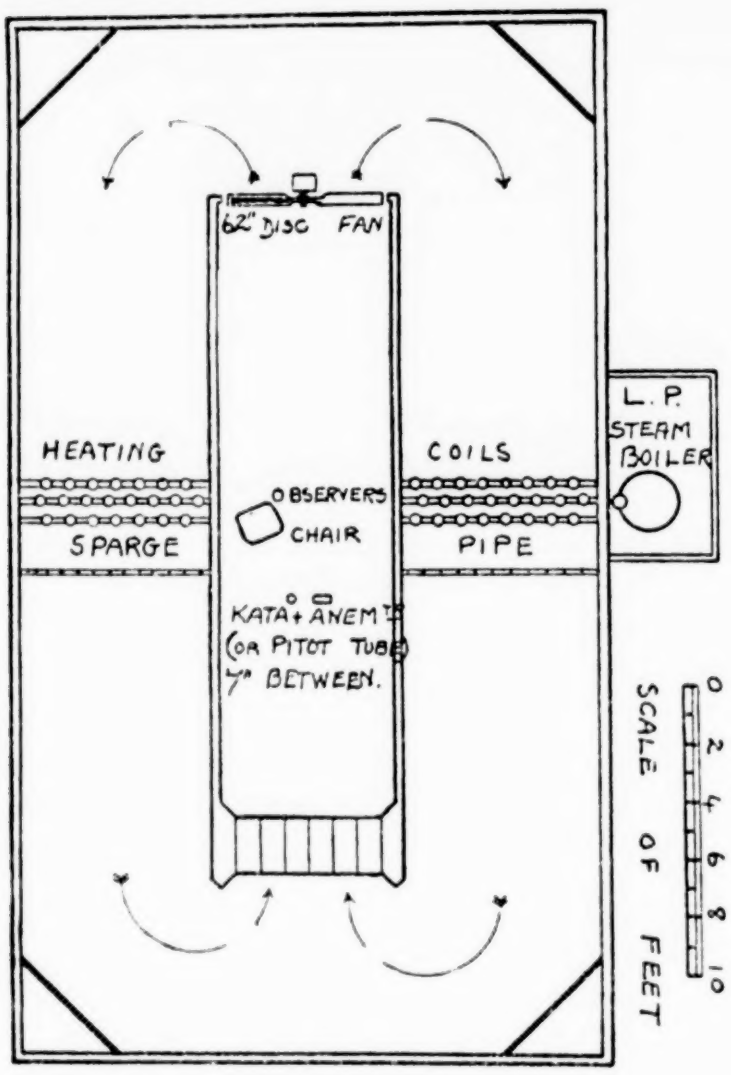

FIG. 1.—Diagram of wind tunnel.

eddies from the fan. The starter supplied by the makers gives eleven different speeds; in order to enable lower speeds to be obtained, an extra high resistance with seven studs was added when necessary, and to give fine graduations of speed, a sliding rheostat was shunted across the field coils of the motor. These arrangements proved to be quite satisfactory.

The kata-thermometer and instruments for measuring air velocity were placed $3\frac{1}{2}$ inches on either side of the central plane of the inner tunnel (as shown in Figure 1) and 30 inches above the floor, and further to one side were placed the wet and dry bulb thermometers (not shown). Thus the kata and the anemometer were nearly 30 inches from the nearest wall and 30 inches above the floor.

The thermometers were graduated to 0.1°C. and their bulbs were enclosed in a bright tin-plated case through which air was constantly drawn at high velocity by a Keith-Blackman enclosed blower. This insured a quick adjustment of the thermometers to any small changes of temperature and a constant air velocity over the wet bulb, irrespective of the air speed in the tunnel. The wick supplying distilled water to the wet bulb covering passed through the tin-plated case *via* a rubber tube, so that no evaporation of water should occur on its way to the bulb.

The temperature of the tunnel was controlled by admitting steam to the two sets of pipes or grids in the outside passages on either side of the tunnel proper, thereby heating the whole building by contact with the air, which could be circulated by the fan to assist rapid and even warming. Expense forbade the provision of any cooling plant, so that for low temperatures we had to rely on obtaining suitable out-of-door conditions.

Humidity could be increased either by means of a sparge pipe attached to the low pressure boiler, or by sprinkling floors, walls, and ceilings with water, or by both means used together. The heating grids enabled us to obtain fairly low relative humidities at high temperatures, but at low temperatures there was no means of obtaining drier air than that occurring out of doors on a frosty winter's day. As we were chiefly concerned with high temperatures and humidities, this did not matter.

Air velocity was measured in two ways: For velocities over 1 meter per second a pitot tube placed beside the kata-thermometer and 7 inches away from it was used; its velocity pressures were read with great accuracy by a Chattock gauge, the screw head of which, when rotated through one of its smallest divisions, would alter the head of water by 0.001666 cm. Due corrections were made for air density variations with height of barometer and temperature in calculating the air velocities from the velocity head; the alterations in density due to the changes in humidity were found too small to be considered.

For measuring velocities between 2 meters and 0.3 meter per second a Tycos vane anemometer was used. This was supplied by Messrs. Short and Mason to the specification of Mr. E. Ower of the National Physical Laboratory, where the anemometer was calibrated for us.

We made no attempt to work at velocities below the range of the Tycos in these experiments, such measurements having been very carefully made previously by the whirling arm method. It was found that between 1 meter and 2 meters per second, a range that could be covered by both the pitot tube and the Tycos, these instruments agreed within a few centimeters per second—well within our limits of experimental error. We also found that the variation in the Tycos readings, due to variations in the density of the air from that which obtained during calibration to that recorded during the experiments, was quite negligible.[1]

[1] We are much indebted to Mr. E. Ower of the National Physical Laboratory for his valuable advice and help in checking the accuracy of our air velocity measurements.

Discussion of Data

These observations covered a range of air velocity from 0.31 meter per second to 5.2 meters per second, of dry bulb temperature from −1.7°C. to 44.5°C., of wet bulb temperature from −2.5°C. to 33.5°C., of relative humidity from 28 per cent. to 95 per cent., and of atmospheric pressure from 735 mm. to 760 mm. As far as possible the bulk of the observations were taken at the same definite values of air velocity—*viz.*, 0.5, 0.75, 1, 1.5, 2, etc., meters per second—in order to get observations over a wide range of temperature at each given velocity. An attempt was also made to vary the amount of moisture in the air without at the same time varying the temperature; owing to the difficulty of doing this exactly, however, the range of the relative humidity attained for any constant temperature has not been very large, though probably it covers the humidities which would occur under the conditions in which the kata is generally used.

The total number of dry kata readings taken was 142, and of wet kata 255; when these were plotted for constant velocities against dry or wet bulb temperature, respectively, three of the dry kata and fourteen of the wet kata readings fell so far from the general trend of the rest that they were obviously errors of some sort. These observations were in each case repeated as closely as possible under the same conditions and every time the fresh values found were more consistent with the general trend. This seemed to justify rejection of these apparent errors; hence they have not been used in calculating either the equations for the smoothed lines or the variation about these lines. These

errors are shown on the graphs, and marked with a query in each case. The seven observations in which the dry bulb temperature was below freezing, and also the nine in which the air in the wind tunnel was so still that the air velocity was not measurable by the apparatus used, were also omitted from these calculations; the former because the covering of the wet bulb thermometer became frosted, and the latter because the exact velocity, which probably differed from zero, could not be found. All these are, however, shown on the graphs.

Kata Factor

A single kata was used throughout. Its factor, as determined by the still air chamber method (using Griffith's empirical formula, factor = 0.27 $\Theta \times$ cooling time in still air), which is the method used by the makers, was 462. Angus has redetermined the factor by one of the direct methods described in his 1924 paper (1)—*viz.*, that in which the kata was cooled through its working range in a special calorimeter filled with mercury—and finds it to be 518, an increase in value of 12 per cent. In the paper referred to above, Angus showed that in his experiments the still air chamber method gave variable results for the factor at different temperatures, but he found that these results were approximately constant at temperatures from 10° to 20°C. These variations seem to be due to convection currents. Vernon (2), on the other hand, found a continual increase in the results with temperatures rising from 10°C. to 30°C.; Weiss' results (3, Table 1, p. 49) show only irregular variation of the factor with temperatures from 10°C. to 29°C. The factors of various katas determined more accurately (more accurately, that is, according to the theoretical definition of the factor), by direct measurement of the heat loss, were all found by Angus to be higher than those obtained by the still air chamber method. Some confusion has arisen from the ambiguous use of the words "variability of the kata factor." This does not mean that the actual physical constant—amount of heat lost in millicalories per square centimeter by the kata bulb in cooling from 100°F. to 95°F.—(by which the factor was originally defined) is itself a variable at different temperatures; it means, rather, that the approximations made to this constant by the still air chamber method are imperfect and vary according to the temperature at which they are made. The difficulties of more exact calibration have led Hill and Vernon to suggest that it would be most practicable for the makers to continue using this method of finding the kata factors but always at the same standard temperature of 60°F. This would give greater comparability with past readings. This means that the kata readings derived from the factors so determined, and also those hitherto used, do *not* give the rate of heat loss in millicalories per square centimeter per second, but give an underestimate of this rate possibly to the extent of from 12 to 20 per cent., and that the unit of H and H′ is to some extent an artificial one.

In the present work, therefore, the still air chamber factor 462 has been used, so that the equations and nomograms given here should be applicable to the readings obtained by using the kata factors as marked by the makers.

If it is required to translate these

relations into those involving actual rate of heat loss in millicalories per square centimeter per second, the best approximation that can be given at present is found by multiplying the values of H and H′ given by these equations or nomograms by 1.1212—*i.e.*, by the ratio of the factor 518 to the factor 462; or, conversely, if the nomogram and equations are to be used to find v from an observed value of H derived from a factor found by one of the more accurate direct methods, and so nearer the actual rate of heat loss in millicalories per square centimeter per second, the observed H or H′ should be multiplied by 0.8919 before using the nomogram or equation to find v from it.

Dry Kata

The nomogram given in Figure 2 connects the three variables, dry kata reading, dry bulb temperature, and air velocity. To read off any one of these, join the observed values of the other two by a straight edge, and read off the required value at the point where the straight edge cuts the third scale. If Scale I has to be used for the temperature, Scale I must also be used for the kata; if Scale II is used for the temperature, Scale II must also be used for the kata. The scales are given in both centigrade and Fahrenheit and in both meters per second and feet per minute.

Study of the graduations of the scales for air velocity and temperature shows under any given conditions whether it would be easier to alter the cooling power by changes in the temperature or by changes in the air velocity. This nomogram has been drawn[2] from the equation

$$H = (0.50803\sqrt{v} + 0.10551)(36.5 - t) \quad (1)$$

where H = dry kata reading
v = air velocity in meters per second
t = dry bulb temperature in degrees centigrade

Expressed in feet per minute and in degrees Fahrenheit, this equation becomes

$$H = (0.020116\sqrt{V} + 0.05862)(97.7 - T) \quad (1a)$$

where V = air velocity in feet per minute
T = dry bulb temperature in degrees Fahrenheit

The equation was found empirically by fitting a line of the form $H = (a + b\sqrt{v})\theta$, where $\theta = 36.5 - t$, to the 124 new observations available. It was found that a line of this form fits within the experimental error throughout the range of air velocity used.

The observations on which equations 1 and 1a are based extend only over the following ranges: air velocity 0.31 meter to 5.2 meters per second; dry bulb 0° to 44.5°C.; wet bulb 0° to 33.5°C.; relative humidity 28 to 95 per cent.; barometer 735 to 760 mm. Extrapolations beyond these ranges should not be made.[3] These equations can be taken only as approximate, not as exact, as the observations on which they are based are subject to experimental error which is greater in the case of the wet kata than in the case of the dry.

The values given above for the constants a and b were found by making

[2] For method of drawing nomogram, see Appendix.

[3] Correction for barometric pressure can be made by use of the formula

$$H_1 = \frac{H_0}{2}\left(1 + \sqrt{\frac{p_1}{p_0}}\right)$$

where H_0 is the heat loss at standard pressure p_0 and H_1 is the heat loss at any other pressure p_1.

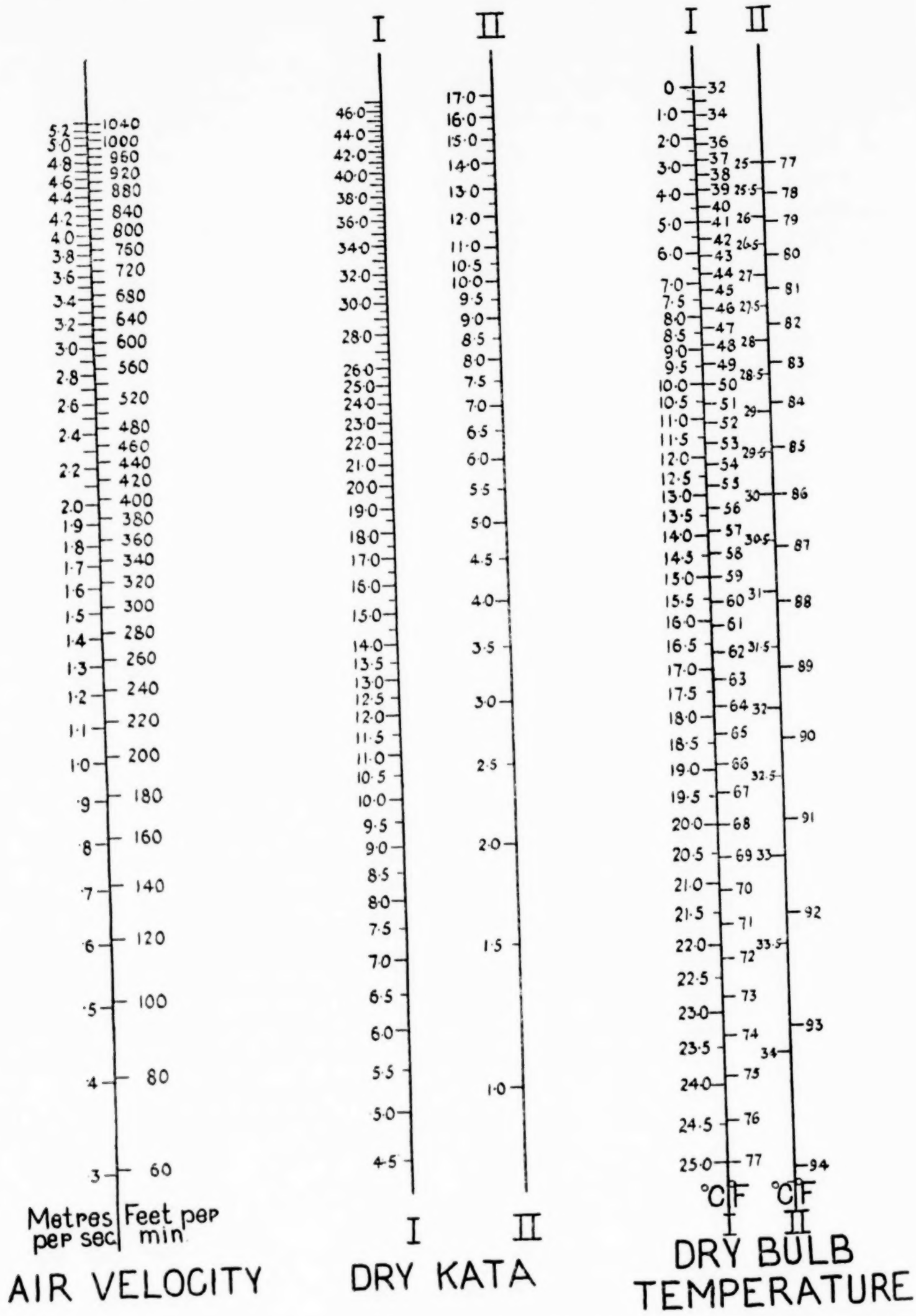
WHEN SCALE I IS USED FOR TEMPERATURE SCALE I MUST ALSO BE USED FOR KATA
" SCALE II " " " " SCALE II " " " " " "
I II I II
Metres per sec
Feet per min
AIR VELOCITY
DRY KATA
DRY BULB TEMPERATURE
°C F °C F

FIG. 2.—Nomogram for dry kata.

the root-mean-square deviations of H a minimum. Other ways of fitting have also been tried—*viz.*, making the root-mean-square deviations of $\sqrt{v}$ a minimum; this gives

$$H = \frac{(0.50083\sqrt{v} + 0.1104)}{(36.5 - t)} \quad (2)$$

and also making the root-mean-square deviations of H/Θ a minimum; this gives

$$H = \frac{(0.4761\sqrt{v} + 0.1407)}{(36.5 - t)} \quad (3)$$

Equations 1 and 2 give practically the same values of H over this range, and, since H and v are the values of direct interest rather than H/Θ, equation 1 seems the best to use. The differences between these three equations arise from experimental errors. These have to be smoothed out more or less arbitrarily, and the three different methods of smoothing naturally do not give identical results.

Comparison with Former Results.—Other sets of equations exist for the kata—the former equations of Hill and Hargood-Ash (4):

$$\left.\begin{array}{l} H = (0.47\sqrt{v} + 0.13)\ (36.5 - t) \text{ for velocities between 1 meter per second and 17 meters per second} \\ H = (0.40\sqrt{v} + 0.20)\ (36.5 - t) \text{ for velocities below 1 meter per second} \end{array}\right\} \quad (4)$$

Weiss' equation (3):

$$H = (0.49\sqrt{v} + 0.14)\ (36.5 - t) \quad (5)$$

and Bradtke's equation (cited in (5)):

$$H = \frac{(0.403\sqrt{v} + 0.10)}{(36.5 - t)^{1.06}} \quad (6)$$

The range of air velocities on which equations 4 were based was from v = 0.03 meter to v = 16.8 meters per second; the range on which equation 5, that of Weiss, was based was from v = 0.163 meter to v = 9.05 meters per second, and throughout this range this same line fits his observations. We have not yet seen Dr. Bradtke's account of his formula, and no reference is given in Rosenthal's paper from which we quote it.

The new equation 1, it was found, agrees very closely with Weiss' equation at the higher velocities; at the lower velocities (*i. e.*, v = 3.5 meters to v = 0.32 meter per second) Weiss' equation is slightly above equation 1, but the difference is small. Hill and Hargood-Ash's former equation lies below the others at the higher velocities and rather above them at the lower velocities. These observations at lower velocities in the former observations were taken by the whirling arm method. The differences as shown by H/Θ plotted against v can be seen in Figure 3, but perhaps the best idea of the points of agreement and of difference in the three sets of observations is given by Figure 4, which shows the observed values of H/Θ for all three sets plotted against $\sqrt{v}$. It is clear from this plot, and from the fact that the katas are calibrated so that $H/\Theta = 0.27$ in still air, that neither the new equation nor Weiss' equation can be applied right down through the lowest velocities to v = 0, as any straight line for H/Θ on $\sqrt{v}$ that fits the higher velocities would give values too low in the neighborhood of v = 0. Owing to unmeasurable convection currents, the velocity measured does not represent the true air velocity in the immediate neighborhood of the kata bulb, but must be below this; hence, when, as in

these graphs, the *measured* air velocity (*i.e.*, the air velocity minus convection currents) is taken as the dependent variable, a change of form of the curve as v approaches zero is only to be expected.

in a higher power of temperature. Bradtke's suggested amendment—using $(36.5-t)^{1.06}$ instead of $36.5-t$—would make some correction for such a tendency. Angus' work on the kata factor referred to above (1) also shows

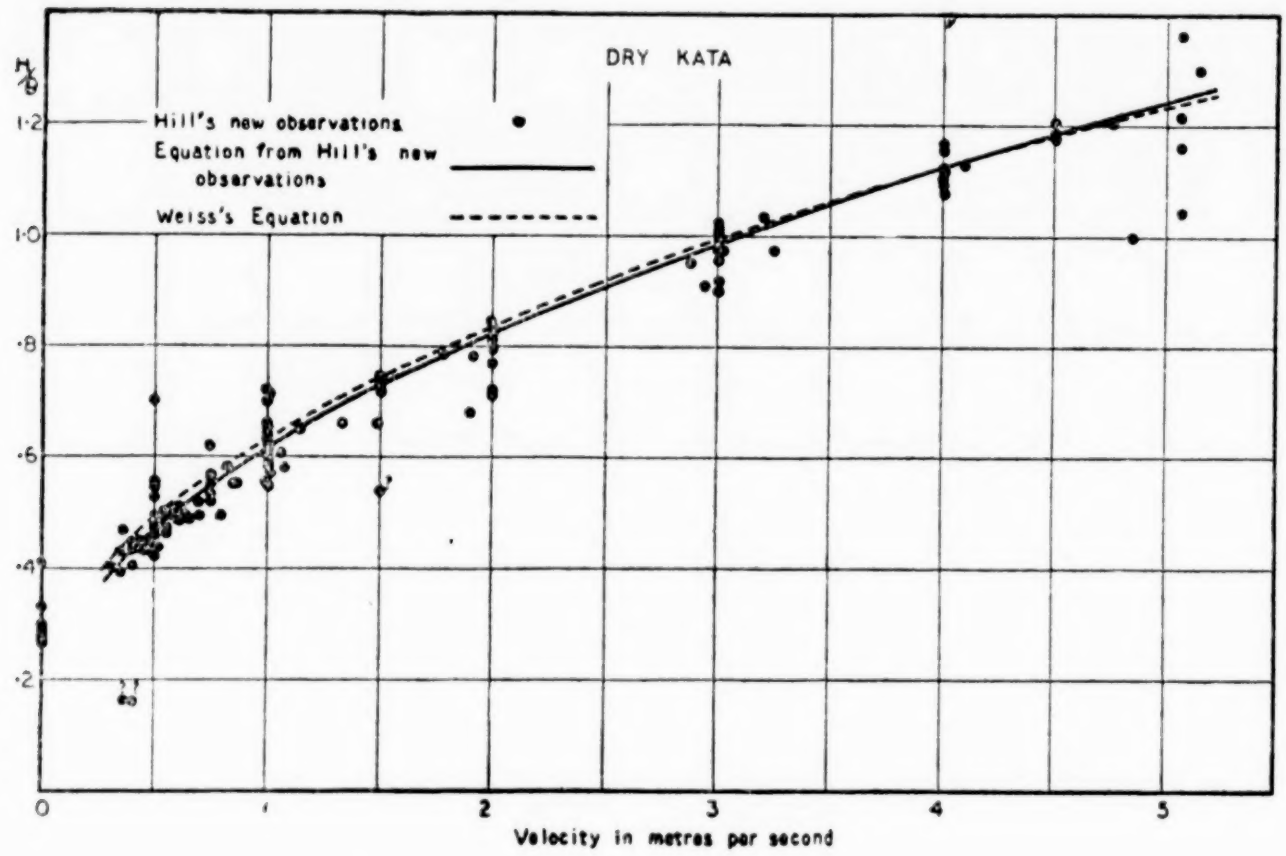

FIG. 3.—Relationship between H/θ and air velocity.

Since the new observations do not go below v = 0.32 nor above v = 5.2 and since both at the lower and at the higher velocities there is some difference between Weiss' results and Hill's former results, the nomograms have not been continued beyond the range which the new observations cover, and the equations derived from these observations should not be extended beyond this range.

Vernon (2) has also made a series of observations, using the whirling arm method. He found that, for a given air velocity, H/θ was apparently not constant, but was higher for lower temperatures than for higher ones. This would entail a less simple relation than that given above, bringing

that H/θ is not really constant in still air for all temperatures. Vernon's observations were taken at two temperatures only, 24°C. and 10°C. The differences were not great, but they were consistent. At the lower velocities Vernon attributes them to the varying effect of convection currents at different temperatures, and for the higher velocities he suggests varying humidity as the cause. The present observations do not, on the whole, show the same tendency, but they do not cover such low velocities. The observed values of H/θ have been plotted against temperature for certain constant velocities but for considerations of space the graphs are not reproduced here. At an air velocity

of 3 meters per second the values of H/Θ have the same tendency to decrease as the temperature increases as Vernon's did, but at the other velocities this tendency does not appear. The new straight line equation gives a slightly better fit to these observations than does Bradtke's; the root-mean-square error of H being 0.73 in one case and 0.78 in the other, but practically there is very little difference in the values of H given by either.

Hence, on the whole these observations do not suggest that, for practical purposes and taking into account the size of the experimental error, a more complicated form of the equation of H/Θ against $\sqrt{v}$ than a straight line is necessary for the range covered. Vernon's observations differ from the present ones, both in being carried out by the whirling arm method, instead of in a wind tunnel, and in covering a lower range of air velocities than can be measured in the wind tunnel, but the two sets do overlap to some extent—*viz.*, between 0.32 meter and 1.7 meters per second.

Effect of Humidity on Dry Kata Readings.—No measurable effect on the dry kata of humidity apart from temperature appears in these observations. In the plots referred to above, the relative humidity was noted for each observation but no consistent relation could be traced apart from temperature.[4] This is in accordance with former experience (6) and is supported by Weiss' results. If any such effect exists, it either does not appear at the ranges of humidity attained, or is masked by the experimental error.

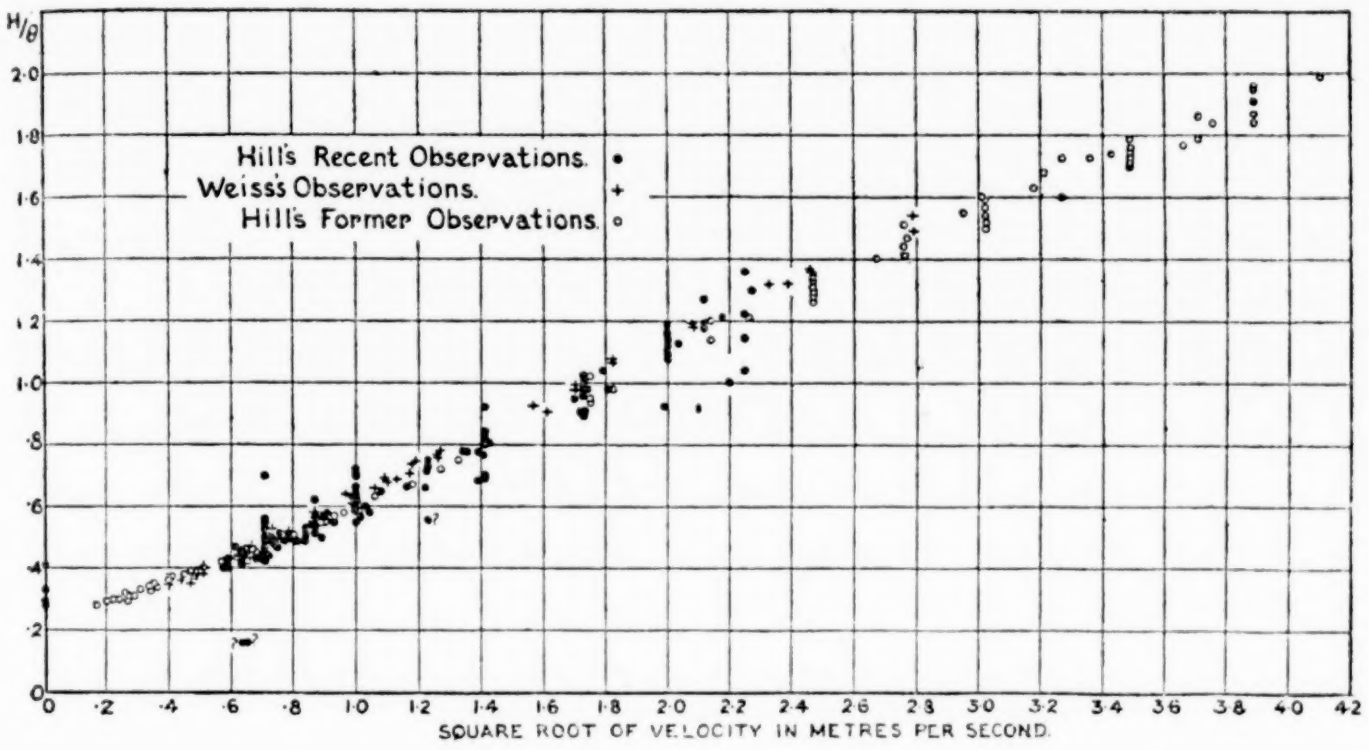

FIG. 4.—Relationship between H/Θ and square root of air velocity.

Accuracy of Relations between Dry Kata, Dry Bulb, and Air Velocity

The variation about the general trend that remains in these observa-

[4] This was also tested by correlating with both relative and absolute humidity the deviations of the observed values of H and also of H/Θ from their values as calculated by the equation. No significant correlation was found.

tions is due to experimental error or to some unmeasured want of stability in the conditions while the observations were being taken, and does not—since only one instrument was used—include any variation in results that may arise with different katas from want of accuracy in the determination of the kata factor. The graphs give an idea of the amount of variation about the general trend. A more definite estimate is given by the root-mean-square deviations of the observed values of H and v from those calculated from the equations.

The root-mean-square error of the observed values of H used is of the order of 0.7 unit of cooling power (*i.e.*, about 5 per cent. of the mean value). It is rather less in absolute value (though naturally greater relatively) as the temperature increases, being only about 0.5 unit in the neighborhood of 30°C. and about 0.8 unit between 0° an 10°C. The accuracy of the determination of H does not with these observations show any regular tendency to increase or decrease with the velocity.

The root-mean-square error of the air velocity as found from the equation was, on the whole, of the order of 0.4 meter per second. It increased from 0.14 meter per second at the lowest temperatures to about 0.9 meter per second at 30° and over, *i.e.*, from about 9 per cent. to about 30 per cent. of the mean value of these particular values of v. At temperatures approaching 30°C. it is clearly impracticable to determine v with any accuracy from H and t. This is obvious from the fact that the lines giving H in terms of t for all different velocities converge to zero at about 36.5°C. The kata-thermometer was not originally designed as an anemometer, but to give a rough idea of the cooling conditions of the human body. If it is needed to use a kata as an anemometer in the neighborhood of 30°C. or over, it would be necessary to graduate it with a cooling range rather higher in the temperature scale, as the nearer the temperature of the air is to the cooling range the less distinguishable is the effect of changing velocity. The graduation of such a kata-thermometer is to be undertaken.

The order of the root-mean-square error of H, even under the controlled conditions of the wind tunnel, shows how difficult it is to obtain accurate observations of atmospheric conditions, and how sensitive the kata is to small changes in these conditions. This applies with still greater force to the wet kata readings. This variation is, however, counterbalanced by the number of observations at each velocity and temperature, so that the final smoothed values should not be far from the true relation. The good agreement with Weiss' equation for the dry kata over the overlapping range is satisfactory, but the fluctuations in the single values impress the importance of taking the average of several readings of the kata, and of noting their agreement or otherwise, before drawing conclusions about the atmospheric conditions.

Wet Kata

The nomogram for the wet kata (Fig. 5) is used in the same way as that for the dry kata, substituting wet bulb temperature for dry bulb temperature, and wet kata for dry kata. The wet bulb temperature used should be

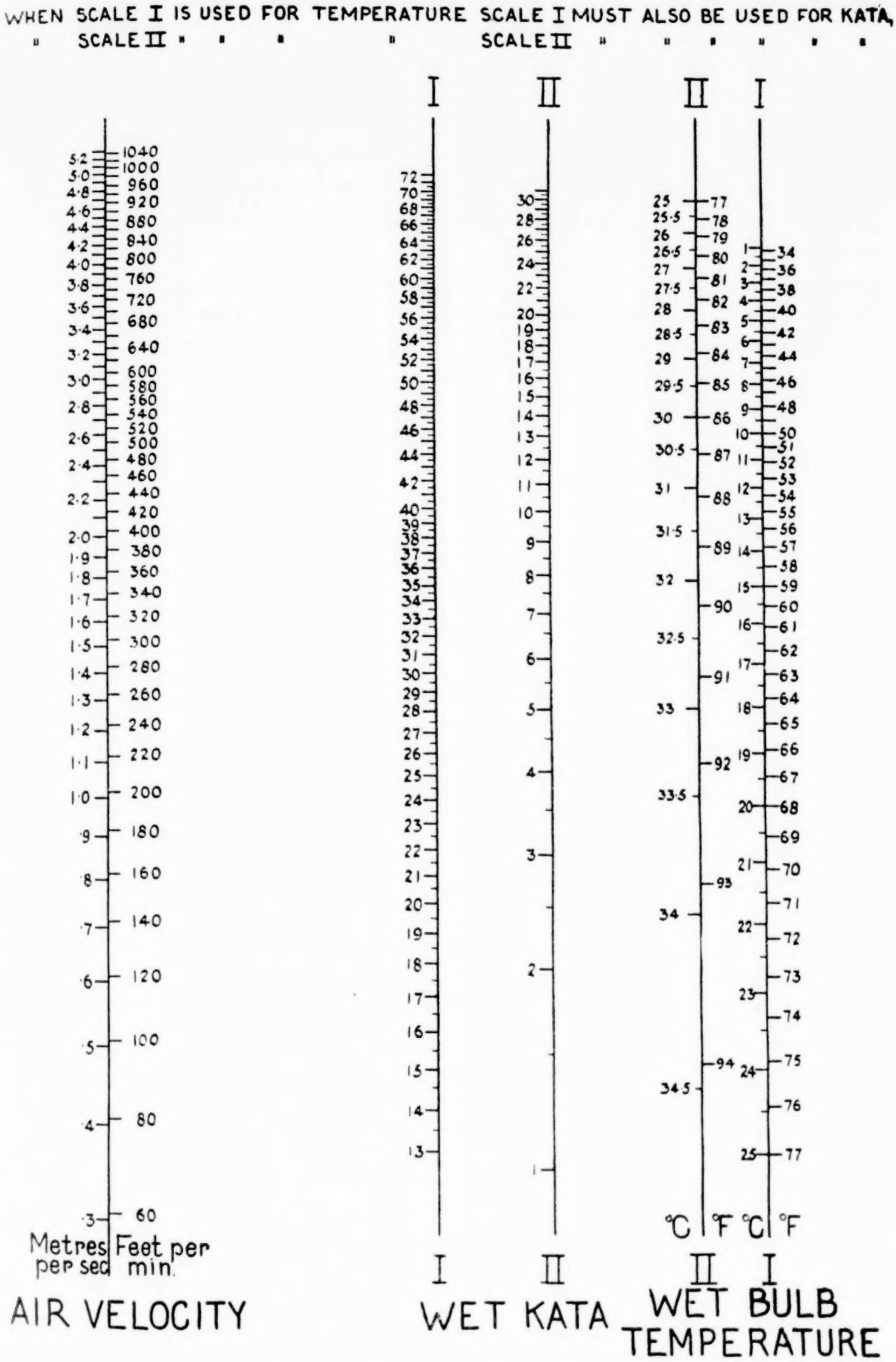

FIG. 5.—Nomogram for wet kata.

the ventilated wet bulb; *i.e.*, if an ordinary wet bulb thermometer is used, the bulb should be vigorously fanned till a steady level is reached before taking the reading. As in the case of the dry kata, if Scale I is used for the temperature, Scale I must also be used for the kata; if Scale II is used for the temperature, Scale II must also be used for the kata.

The equation from which the nomogram has been calculated is

$$H' = (1.115v^{0.4} + 0.268)(28.65 - 0.409t' - 0.00346t'^2 - 0.000224t'^3) \quad (7)$$

where H' = wet kata reading
v = air velocity in meters per second
t' = wet bulb temperature in degrees centigrade

or, translated into degrees Fahrenheit and feet per minute

$$H' = (0.1347V^{0.4} + 0.268)(36.08 - 0.2766T' + 0.00261T'^2 - 0.0000383T'^3) \quad (7a)$$

where V = air velocity in feet per minute
T' = wet bulb temperature in degrees Fahrenheit

As with the dry kata, neither the nomogram nor the equation should be used beyond the range of air velocities over which it was calculated. The method of arriving at this equation follows the lines of a suggestion made by Weiss (3) which has proved to be supported by these observations as well as by his own. Both these sets of observations show that Hill's former equations, which express H' as a linear function of the wet bulb temperature when the velocity is constant, are not valid for all atmospheric conditions. If the wet kata is plotted against the wet bulb temperature for constant velocities, it is clear that a curve of a higher order than a straight line is needed to express the relation. Weiss' suggestion is that the variable having the simplest relation (*i.e.*, a linear relation) with the wet kata reading is the total heat level of the surrounding mixture of air and water vapor, taking into account the latent heat of the water vapor in the air. He defines this variable i as the total heat (taking water—not water vapor—at 0°C. as origin for water vapor, and air at 0°C. as origin for air) in that volume of the surrounding atmosphere which contains 1 kg. of dry air. Another way of looking at it is to imagine the latent heat of the water vapor in the air set free by condensation and used to heat the air above its observed temperature; the resulting temperature has been called by v. Bezold the "equivalent temperature" and the total heat i = equivalent temperature × specific heat of dry air.

The total heat is calculated thus (7):

i = heat in 1 kg. of dry air at temperature t + heat in the water vapor mixed with this weight of air
= t × specific heat of dry air + weight in kilograms of water vapor (latent heat of water vapor at 0°C. + specific heat of water vapor × t)

But the weight of water vapor = specific gravity of water vapor $\times \frac{f}{b-f}$, approximately, if the vapor pressure is not too high, where f = vapor pressure, and b = barometer reading. Hence, using the following constants:

Specific heat of dry air at constant pressure = 0.24
Latent heat of water vapor at 0°C. = 595
Specific heat of water vapor = 0.46
Specific gravity of water vapor = 0.622

$$i = 0.24t + 0.622\frac{f}{b-f}(595 + 0.46t) \quad (8)$$

It is found experimentally, as Weiss points out, that, if the barometer does not vary very much, i is approximately a function of the wet bulb temperature alone, but not a linear function. We find that over the range of values used in the present experiments i can be expressed very closely as a cubic in t.

Weiss found that his observations gave a straight line relation between wet kata and i for constant velocity, and he obtained the equation:

$$\frac{H'}{33 - i} = 0.18 + 1.24v^{0.4} \qquad (9)$$

This gives on the whole a very good fit to his observations. The constant 33 is the approximate value of i for saturated air at 36.5°C.—the mid-point of the cooling range. The present observations also failed to give straight lines when plotted against wet bulb temperature for given constant velocities (see Fig. 6 for example at v = 1), but they agree with Weiss' observations in so far as they give fairly good straight lines when plotted against i for constant velocities (see Fig. 7 for example at v = 1). These observations, however, differ from those of Weiss, for each velocity, in that they fall fairly consistently below his values and are also rather more variable. Theoretically the lines derived from the equations should all converge to the point i = 33—*i.e.*, the mid-point of the cooling range.[5] This is fulfilled in the case of Weiss' observations; owing to the lower average values of the present wet kata readings, however, it was found that the straight lines which best represent their course appear to converge somewhere in the neighborhood of i = 31—the approximate value of i for t′ = 35, the beginning of the cooling range. (See example shown in Fig. 7.) It is not, of course, practicable to get cooling powers very near the range of cooling, so that the form here is not of importance.[6]

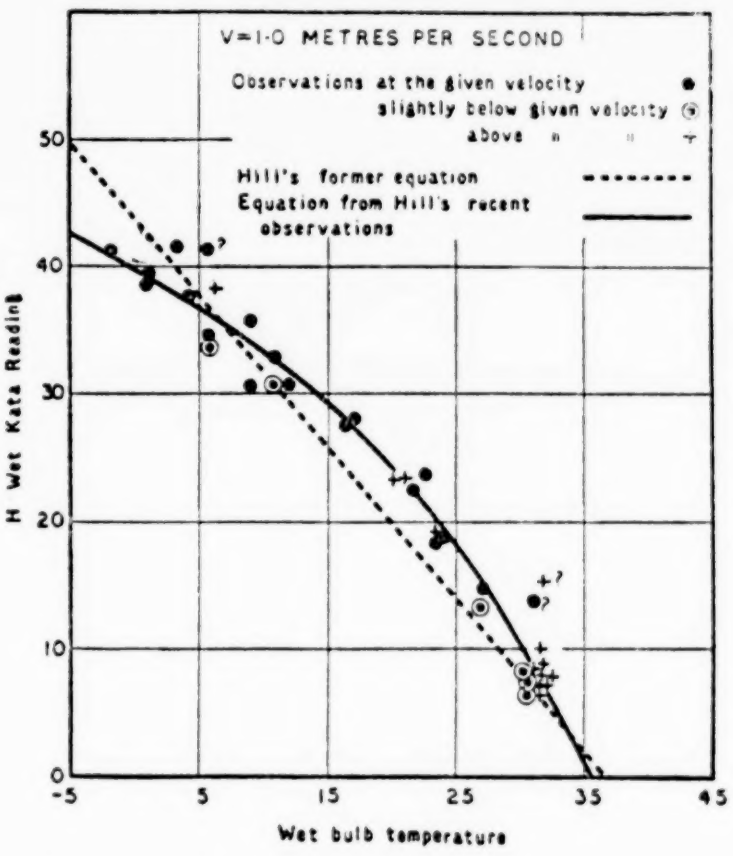

FIG. 6.—Wet kata cooling power in relation to wet bulb temperature in degrees centigrade, at approximately constant air velocity.

We have not been able to explain this difference, which is consistent for each velocity, between the results of the present observations and those of Weiss. In view of the good agree-

[5] Except for the slight difference that at the lower air velocities a wet bulb temperature of 36.5° as registered by the kata would correspond to a rather lower wet bulb as registered by the ventilated wet bulb thermometer.

[6] To get a meaning for points on the lines converging to the mid-point of the range corresponding to temperatures between 35° and 37.8°, we must imagine the kata to be timed while heating over one part of the range and cooling over the other, and the two values of H′ added algebraically.

it must arise in some difference in the conditions of the two experiments that affects only the wet kata or wet bulb; it does not therefore seem likely that the discrepancy can be attributed to differences in the kata factor, since the same instrument was used for both wet and dry, nor to any inaccuracy in the measurement of the air velocity, though either of these would affect the wet kata to a greater extent than the dry kata. The wet bulb readings were taken in Weiss' case by an Assmann psychrometer and in the case of Hill's present observation by a wet bulb thermometer over which air was rapidly drawn all the time. There might be small differences in the ventilation of the wet bulb but this would hardly be enough to account for the discrepancy between the two sets of observations.

We found graphically that the same power of v—*i.e.*, $v^{0.4}$—that fitted Weiss' observations also fitted the present ones, and we obtained the equation

$$\frac{H'}{31 - i} = (1.1147v^{0.4} + 0.268) \qquad (10)$$

by taking the constants 31 and 0.4 as found graphically and making the deviations of H′ a minimum.

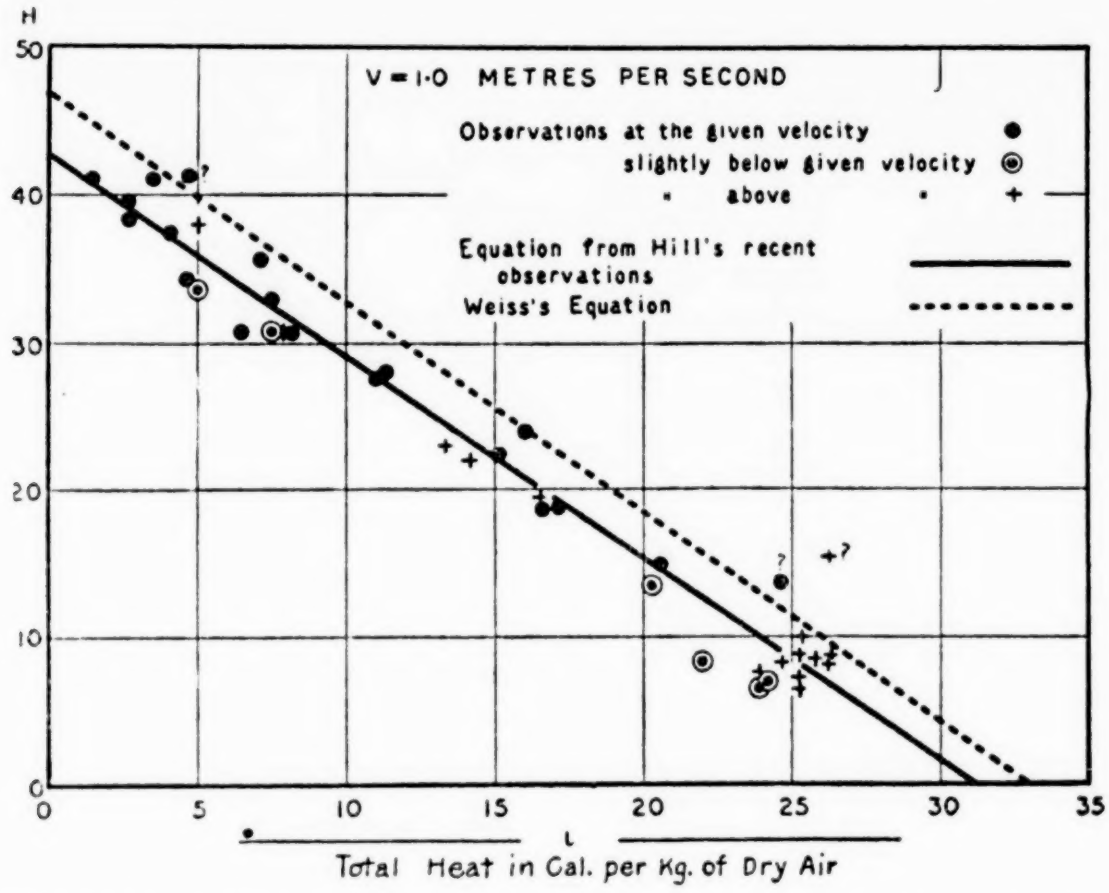

FIG. 7.—Wet kata cooling power (H′) in relation to total heat content of air (i), at approximately constant air velocity.

Weiss reproduces a diagram taken from Mollier (7) connecting i, t, and relative or absolute humidity, for the purpose of substituting in his equation, but for practical use it is more convenient to be able to connect directly the variables observed—*i.e.*, H, v, and t′. We have therefore expressed i in terms of wet bulb temperature by the cubic

$$i = 0.00022367t'^3 + 0.003461t'^2 + 0.4089t' + 2.353 \qquad (11)$$

which fits fairly well over the range of temperatures and humidities covered —*i.e.*, barometer from 735 to 760 mm.,

wet bulb from 0° to 33°C., and relative humidity from 28 to 95 per cent. (see Fig. 8)—but should not be extended beyond this range. This puts equation 10 into the form of equation 7 from which the nomogram has been drawn. The unsatisfactory want of agreement between the wet kata values thus found and those of Weiss should, however, be borne in mind and, till this is cleared up, the wet kata relations taken as only rough approximations.[7] In any case, the wet kata should not be used as an anemometer when the dry kata can be so used, as the dry kata is more accurate.

Accuracy of Wet Kata Values as Found from Equation

The variation of the observed wet kata values about the calculated trend

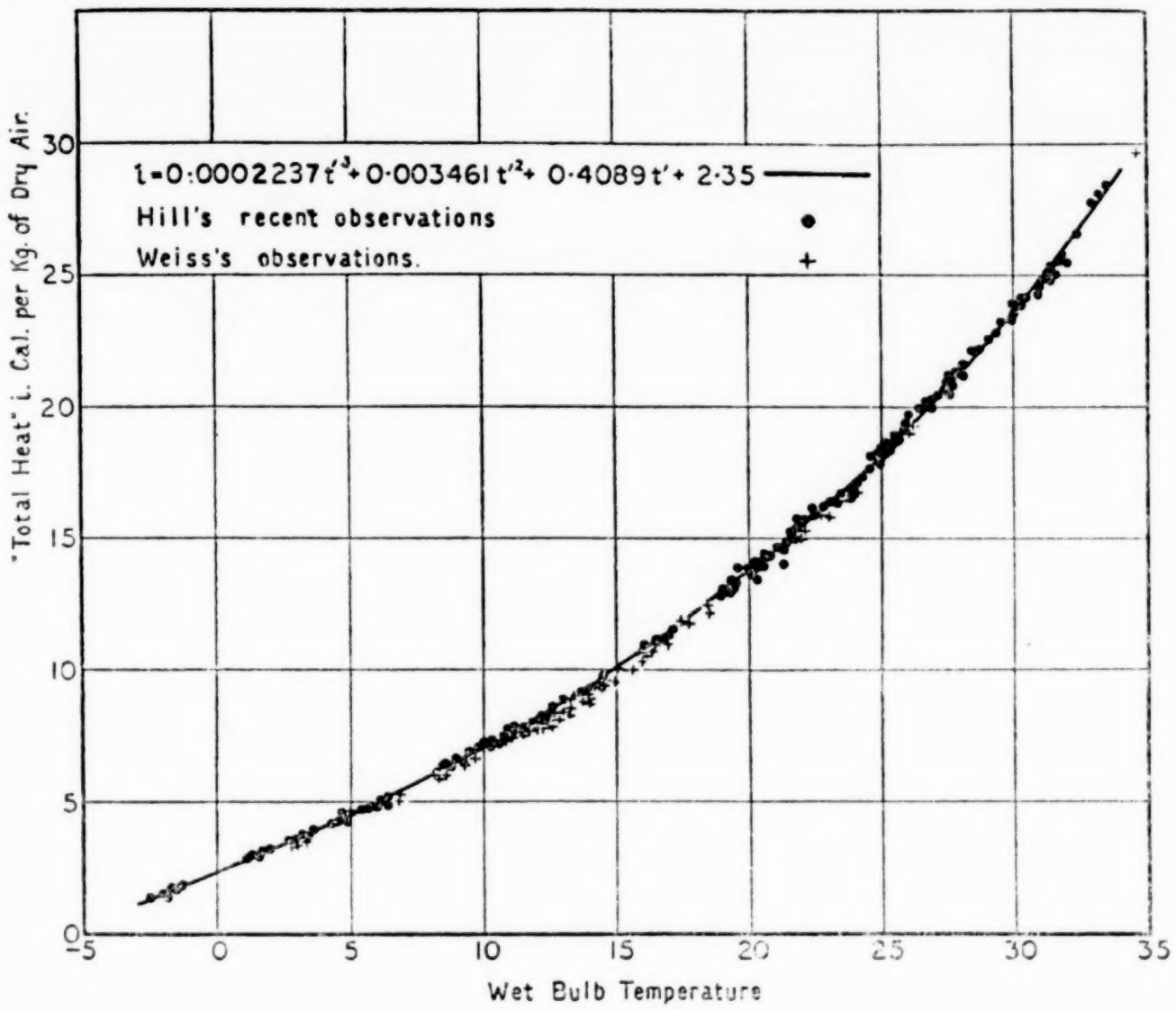

FIG. 8.—Relationship between total heat content of air and wet bulb temperature in degrees centigrade.

is a little more than twice as great as that of the dry kata. The root-mean-square error of H′ taken over all the temperatures is about 1.9—*i.e.*, about 7.5 per cent. of the mean value, whether calculated from equation 10

[7] To see if the difference between our values and Weiss' equation was due to slight differences in calculating i (we used the observed barometer reading in the equation and found f from the equation

$$f = f' - \frac{1}{2}\frac{B}{750}(t - t')$$

while in both these cases Weiss, in most of the observations, took the barometer reading as 755), we have plotted Weiss' values (omitting a few obvious misprints) given for i against wet bulb in Figure 8 and they agree approximately with the cubic; hence the difference cannot be due to this.

using i, or from equation 7 using t′. The values at the lowest temperatures are the most variable.

Although it is quite true, as Weiss has shown, that for constant velocity H′ gives a simpler relation with i than with t′, there is still an unsatisfactorily large variation in the values of H′ when either i or t′ is kept constant.

The newly observed values of $\frac{H'}{31 - i}$ with equation 10 were plotted against v, and similar graphs were drawn for $\frac{H'}{33 - i}$ against v with Weiss' equation, and for an equation

$$\frac{H}{33 - i} = 0.9839v^{0.4} + 0.2705 \qquad (12)$$

found from the new observations and forced to go through the point i = 33 instead of i = 31 for comparison with Weiss' equation (this equation gives a worse fit than equation 10). The scatter in every case was so large that it must be concluded that none of the relations so far arrived at for the wet kata are really satisfactory.

A number of plottings of different values have been made to try to associate this variation with relative or absolute humidity or with dry bulb as well as wet bulb, but so far with no success. This may be due partly to the sensitiveness of the wet kata to small changes in the conditions that have escaped measurement, and partly to the difficulty of getting, say, a good range of dry bulb temperatures for any given velocity while keeping either the wet bulb temperature or the humidity constant.

Appendix

Method of Drawing Nomogram

The equations for both wet and dry katas are of the form

$$F_3 (H) = F_1 (v) \times F_2 (t)$$

and so by taking logarithms can be reduced to the simple form

$$f_3 = f_1 + f_2$$

Hence a nomogram for simple addition is all that is needed. Take three parallel scales AM, CP, and BN for f_1, f_3, and f_2 with the origins A, C, and B collinear, and take any three collinear points M, P, and N, one on each scale (see Fig. 9).

Then, if $\frac{AC}{CB} = \frac{l_1}{l_2}$ (1)

$$\therefore \frac{MP}{PN} = \frac{l_1}{l_2}$$

$$\text{Also } \frac{MP}{PN} = \frac{AM - CP}{CP - BN}$$

$$\therefore \frac{AM - CP}{CP - BN} = \frac{l_1}{l_2}$$

$$\therefore \frac{AM}{l_1} + \frac{BN}{l_2} = CP\left(\frac{1}{l_1} + \frac{1}{l_2}\right)$$

$$\therefore \frac{AM}{l_1} + \frac{BN}{l_2} = \frac{CP}{l_3} \qquad (2)$$

$$\text{where } l_3 = \frac{l_1 l_2}{l_1 + l_2} \qquad (3)$$

Hence if the scales for f_1, f_2, and f_3 are graduated so that an actual length of l_1 units on the f_1 scale is marked as 1 unit of f_1, an actual length of l_2 units on the f_2 scale, as 1 unit of f_2, and an actual length of l_3 units on the f_3 scale, as 1 unit of f_3, it follows from equation 2 that any three collinear points on the scales will give readings that satisfy the equation $f_3 = f_1 + f_2$. The linear units l_1 and l_2 are chosen at will to

make the nomogram a convenient size for the given range so that

$$l_1 = \frac{\text{actual length of } f_1 \text{ scale}}{\text{range of } f_1 \text{ values covered}}$$

$$l_2 = \frac{\text{actual length of } f_2 \text{ scale}}{\text{range of } f_2 \text{ values covered}}$$

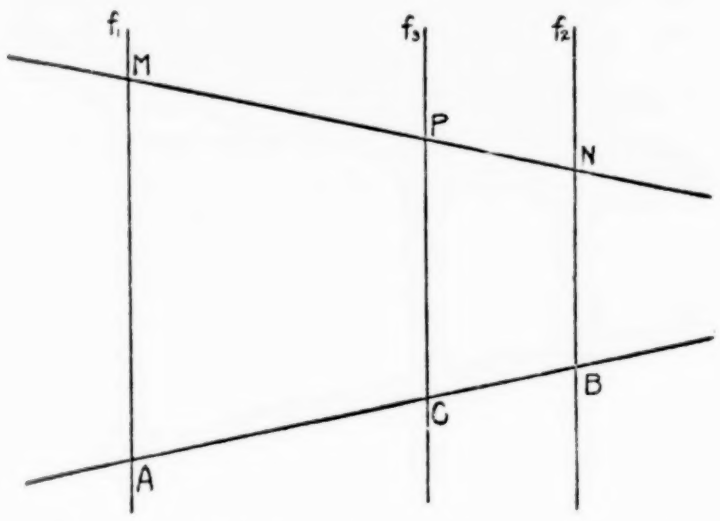

FIG. 9.—Method of constructing nomograms.

and the position of the third scale PC is found from equation 1 and its graduation unit l_3 from equation 3. To avoid undue cramping at one end of the scale, in both cases the scales have been broken into two parts.

The graduation scales used were:

Dry Kata:
Scale I: $l_1:l_2:l_3 = 30:32:15.48387$
Scale II: $l_1:l_2:l_3 = 30:20:12$
Wet Kata:
Scale I: $l_1:l_2:l_3 = 40:40:20$
Scale II: $l_1:l_2:l_3 = 40:13.33333:10$

Since the dry kata equation is

$$H = (0.50803\sqrt{v} + 0.10551)\,(36.5 - t)$$

we have for the dry kata nomogram

$$f_1 = \log\,(0.50803\sqrt{v} + 0.10551)$$
$$f_2 = \log\,(36.5 - t)$$
$$f_3 = \log H$$

And since the wet kata equation is

$$H' = (1.115v^{0.4} + 0.268)\,(28.65 - 0.409t' - 0.00346t'^2 - 0.000224t'^3)$$

we have for the wet kata nomogram

$$f_1 = \log\,(1.115v^{0.4} + 0.268)$$
$$f_2 = \log\,(28.65 - 0.409t' - 0.00346t'^2 - 0.000224t'^3)$$
$$f_3 = \log H'$$

and the scales are marked with the corresponding values of v, H, t, and v, H′, t′, respectively.

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BOOK REVIEW

RIETSCHEL-BRABBÉE HEATING AND VENTILATION. A HANDBOOK FOR ARCHITECTS AND ENGINEERS. By *C. W. Brabbée.* Translated for American use from the Seventh German Edition of Rietschel-Brabbée "Heizungs- und Lüftungstechnik." First edition, second impression. Cloth. Pp. xi, 332 with index and illustrations; 7 charts. New York and London: McGraw-Hill Book Co., Inc., 1927.

Dr. Brabbée has rendered a real service by making available in this country the well-known European textbook, "Heizungs- und Lüftungstechnik," by H. Rietschel and C. W. Brabbée. This translation of the German edition has been revised and enlarged for American usage. It is a practical, concise treatise in which broad theoretical discussions have been introduced only in so far as they are necessary for the proper application of physical and physiologic principles to the particular problems discussed.

The book is divided into four parts. Part I deals with indoor and outdoor temperatures and types of heating systems. The greater part of the equipment shown is of German manufacture.

Part II states the objects of ventilation and outlines various natural and mechanical methods for achieving those objects. No comments are made concerning the controversy on natural *versus* mechanical ventilation and the authors are noncommittal in regard to the use of ozone in ventilation work. In discussing the relation between humidity and health, the authors say that atmospheres which are comparatively dry are healthier than those in which a relatively high humidity prevails, stating that the latter is conducive to the transmission of lung diseases. They assume that a relative humidity of 30 per cent. is sufficient and that, under the most unfavorable conditions, relative humidities of from 60 to 70 per cent. may be endured. To the knowledge of the reviewer, such statements are not supported by any authoritative evidence in the literature on ventilation. The matter of the relation between humidity and health has by no means been settled and one should not overlook the fact that the wholesome natural outdoor conditions in spring and fall, which the ventilating engineer endeavors to reproduce indoors, are accompanied by a degree of humidity which is nearer to what the authors call the unfavorable limit than to their optimum limit.

Part III, dealing with the design of heating systems, is probably the most thorough and informative section of the book. It is a clear, concise discussion, in which theory and practice are treated separately, the latter part being devoted to actual examples.

Part IV gives the design of some details of ventilating systems, such as air ducts and chimneys. A set of tables at the end of the book contains useful data pertaining to heat transmission through building materials, pipe sizes, and radiator constants. The text is supplemented by seven charts on hot water and steam heating and ventilating ducts.

This book is to be recommended for its treatment of heating problems; on ventilation it is less satisfactory for American practice because it does not include reference to important recent developments in ventilation in this country, particularly in air conditioning.—*C. P. Yaglou.*

SUBJECT INDEX TO VOLUME X

This is a subject index to all the reading matter in the JOURNAL OF INDUSTRIAL HYGIENE, and one should, therefore, look for the subject word, with the following exception: "Book Notices" are indexed under this title on page 411. The name of the author follows the subject entry in parenthesis.

For author index, see page 413.

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ABSTRACT OF THE LITERATURE
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INDUSTRIAL HYGIENE

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GENERAL

INTERNATIONAL ASSOCIATION FOR THE STUDY AND IMPROVEMENT OF HUMAN RELATIONS AND CONDITIONS IN INDUSTRY (I. R. I.), SUMMER SCHOOL MEETINGS HELD IN BAVENO, ITALY, JUNE 19–25, 1927.

The first Summer School held under the auspices of this Association chose as its subject for study "The Elimination of Unnecessary Fatigue in Industry." This was the outcome of a discussion on the human element in industry which took place at the meeting held the previous summer at the Rigi-Scheidegg, Switzerland.

Dr. Lillian M. Gilbreth, American consulting engineer and psychologist, made a special trip from the United States to Italy to act as Chairman for this School, and the speakers were leaders in various fields that have to do with fatigue study. The entire group, lecturers and students, represented

both sexes, coming from fifteen nations, and with many types of education and experience.

A well-balanced program was presented by the ten lectures. Dr. Loriga of Rome and Mme. Thumen of Paris outlined the history of work in this field, and furnished not only an account but an evaluation that was most significant. Dr. Lipmann of Berlin in two lectures rich in information presented graphically and clearly present day knowledge on the length of work and rest periods. This was supplemented by lectures from Dr. Vernon and Mr. Weston, both of the Industrial Fatigue Research Board, London, who gave valuable and practical information of work being done in attempting to eliminate the evil effects of extremes of temperature, dust, damp, and eyestrain. These four lectures, with one by Mr. Piacitelli of the Barber Asphalt Co., U. S. A., showing applications of fatigue elimination in industry, and especially in teaching new work, served to give a good idea of the fatigue study of today.

The remaining three lectures, given by Professor Pear of Manchester, England, indicated the relation of work to temperament and to self-expression. Professor Pear showed not only the underlying causes of much that has occurred, but suggested possible developments and stimulated the group to a new attack on the fundamental roots of fatigue.

As was to be expected from a group containing workers, managers, scientists, factory inspectors, social workers, etc., the discussion was prolonged and interesting, the main points of which will be incorporated along with the papers in the forthcoming report of the School, which may be obtained from the Secretariat Headquarters of the Association at Goethestrasse 10, Zürich, Switzerland.

The group unanimously agreed that more such Summer Schools should be undertaken. Next year brings the triennial Congress; but undoubtedly a School on some related subject will be held in the summer of 1929, since, under the direction of the I. R. I. which naturally stresses the universal human side of industry, an exchange of information and of viewpoints from a group whose members are so varied and yet so co-operative cannot fail to be of special value.

TEACHING INDUSTRIAL HYGIENE TO FACTORY INSPECTORS. *P. Cazeneuve. Abstr. as follows from Ann. d'hyg. pub., indust. et sociale, 1927, vol. 5, pp. 133–141, in Bull. Hyg., Aug., 1927, vol. 2, pp. 636–637.*

The claim is made that rapid advances in industrial methods and in industrial legislation call for increasing knowledge in the inspectorate that has to administer the law and safeguard the workers. The present methods of recruiting inspectors are then examined and held to be imperfect in that they do not insure that candidates permitted to sit for examination have undergone any training in industrial hygiene. Such training, it is stated, can be obtained only at a few places, and notably at the University of Lyons. The recommendation is made that candidates who have undergone such training, should be given preferential consideration. [What is said refers to the position in France. It applies with even greater force to Great Britain, for industrial hygiene is only taught here in courses of instruction for a Diploma of Public Health, to which only qualified practitioners are admitted.]

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

CHRONIC RHEUMATISM IN ITS RELATION TO INDUSTRY. *W. Wilcox. Jour. Roy. San. Inst., Aug., 1927, vol. 48, pp. 56–69.*

Industrial efficiency, the greatest asset to a nation, is impaired by sickness to which rheumatism contributes largely. It may be acute or chronic; and, if chronic, nonarticular or arthritic. Records are scarce; but 11 per cent. of all sickness in Berlin is ascribed to rheumatism; while, in Great Britain, the attack rate for rheumatic diseases was 30.5 per thousand in insured males and 22.5 per thousand in insured females, and accounted for one-sixth of male sick absence and one-seventh of female. The sick benefit paid on this account annually is about £2,000,000. Chronic rheumatism is not a local disease, but a local manifestation of a general pathologic condition due to focal infection, inherited diathesis, skin conditions, climate, diet, or occupation. Different occupations exhibit different forms of rheumatism. Dental sepsis accounts for 50 per cent. of cases; bathing and skin cleanliness are valuable in prevention and in treatment. —E. L. C.

A LECTURE ON MULE-SPINNERS' CANCER: CLINICAL FEATURES AND TREATMENT. *A. H. Southam. Abstr. as follows from Brit. Med. Jour., Feb. 26, 1927, pp. 366–367, in Bull. Hyg., Sept., 1927, vol. 2, p. 692.*

In his lecture in the Post-Graduate Course of the Manchester Committee on Cancer, the author summarizes the steps that have been taken both by the government and by the cotton spinning industry in their investigation as to the causation and means of prevention of mule spinners' cancer, of which up to date 667 cases have been traced. He describes the clinical features of the disease, and emphasizes the importance of early diagnosis and treatment when scrotal papillomata, apparently benign, make their appearance in mule spinners. Operative removal of the growth and the inguinal glands at the same time is essential if recurrence or metastases are to be prevented, and postoperative X-ray treatment as a routine is advocated.

CAN TAR CAUSE PULMONARY CANCER? *Abstr. from Lancet, March 12, 1927, vol. 1, p. 582, in Bull. Hyg., Sept., 1927, vol. 2, p. 690.*

The death of a Manchester gas retort worker, on whom an inquest was held, was found by postmortem examination to have been due to a primary pulmonary growth. The man had followed his employment for twenty-six years, had worked a good deal with tar, and had previously undergone an operation for epithelioma of the scrotum, but no connection between the eradicated scrotal disease and that in the lung was found. The question was raised as to whether the pulmonary growth had been induced by the inhalation of tar fumes. No conclusive evidence having yet been established, an open verdict was returned.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

THE RELATIVE TOXICITY OF BENZOL AND ITS HIGHER HOMOLOGUES. *J. J. Batchelor. Am. Jour. Hyg., May, 1927, vol. 7, pp. 276–298.*

This study was undertaken with a view to determining the benefit likely to result from the substitution of some of the higher homologues of benzol for benzol itself in certain industrial processes.

"In the present investigation the four solvents [benzol, toluol, xylol, and Hi-flash naphtha] . . . . were each administered to different groups of animals by subcutaneous injection, by intraperitoneal administration, and by inhalation of ascending vapor concentrations. The solvents were diluted with equal volumes of olive oil for the subcutaneous and the intraperitoneal injections, to lessen irritation and to lead to a more gradual absorption of the solvent. Daily observations were made with reference to each animal's general condition, its behavior, the appearance and progress of signs and symptoms, the weight curve, and the effect produced on blood cell counts. A final pathological study was then made of the lesions produced in the various tissues and organs."

Intraperitoneal Injections

1. Benzol.—With benzol there resulted a neuro-irritant action manifested by profound tremor and muscular convulsive twitchings. These symptoms were obtained with doses as low as 0.25 c.c. per kilogram weight and were present with all doses beyond this point. Recovery was the rule with doses below 1.25 c.c. per kilogram. The lethal dose appears to lie between 1.5 and 1.75 c.c. per kilogram.

2. Toluol.—The effects were less prompt and doses up to and including 0.75 c.c. per kilogram weight were productive of little effect apart from apathy. The lethal dose was around 1.75 to 2 c.c. per kilogram, death resulting from respiratory failure.

3. Xylol.—No neuro-irritant action resulted, no tremors or twitching being present. Little effect was noted with doses up to 0.75 c.c. per kilogram weight. The lethal dose seemed to lie between 2 and 2.5 c.c. per kilogram. Onset of symptoms was more delayed than with benzol or toluol.

4. Hiflash Naphtha.—Hypnotic and soporific effects were produced by doses of 0.25 c.c. The lethal dose was around 2.5 c.c. per kilogram weight. The onset of symptoms appeared later than with the other solvents used and neither the neuro-irritant nor the true narcotic effect obtained.

The order of toxicity of the four substances in acute poisoning by intraperitoneal injection appears to be benzol, toluol, xylol, and Hiflash naphtha, decreasing in the order named.

Subcutaneous Injection

1. Benzol.—An average of thirteen injections of 1 c.c. per kilogram of body weight resulted in loss in weight of 26 per cent., reduction in red cells of about 28 per cent. and in white cell count of 91 per cent. The lethal

dose lies between 1.25 and 2 c.c. per kilogram.

TABLE 1

	CHANGE IN WT. %	REDUCTION IN WHITE CELLS %	SYMPTOMS
High Concentration[1]			
Benzol.....	−28	63	Marked, neurotoxic
Toluol.....	−21	0	Narcosis, death
Xylol.....	−10	9	Narcosis, death
Hiflash naphtha..	....	....	.....
Moderate Concentration[2]			
Benzol.....	−14	81	Moderate
Toluol.....	−3	13	Slight
Xylol.....	−3	8	Slight
Hiflash naphtha..	−10	12	Slight
Low Concentration[3]			
Benzol.....	−15	91	Prac. none
Toluol.....	+1	15	None
Xylol.....	+3	4	None
Hiflash naphtha..	−2	9	None

[1] Benzol 2,440 p.p.m. Toluol 1,600 p.p.m. Xylol 1,600 p.p.m.

[2] Benzol 815 to 1,035 p.p.m. Toluol 1,100 and 1,250 p.p.m. Xylol 980 p.p.m. Hiflash naphtha 567 p.p.m.

[3] Benzol 460 p.p.m. Toluol 620 p.p.m. Xylol 620 p.p.m. Hiflash naphtha 312 p.p.m.

2. Toluol.—An average of sixteen injections resulted in loss in weight of 6 per cent. and an average red cell reduction of only 5 per cent. Little effect was produced in white cell count. The lethal dose ranges from 1.25 to 2 c.c. per kilogram.

3. Xylol.—An average of ten injections showed 3 per cent. average loss in weight, reduction of 10 per cent. in red cells, and a lethal dose between 2 and 2.5 c.c. per kilogram.

4. Hiflash Naphtha.—An average of eleven injections resulted in loss of weight of 4 per cent. and reduction in red cells of 5 per cent. The lethal dose is 2.5 c.c. per kilogram.

Inhalation

The results of the inhalation experiments are summarized in Table 1 (reproduced from Table 5 of the original article).

The author concludes that toluol, xylol, and Hiflash naphtha are vastly superior, viewed from a toxic standpoint, to benzol as used in industry and that these homologues are practically devoid of the industrial hazard involved in the use of benzene.—M. G. P.

CARBON MONOXIDE POISONING IN INDUSTRY. *M. R. Mayers. Am. Jour. Pub. Health, Feb., 1927, vol. 17, pp. 108–113.*

This paper is in the nature of a preliminary report on the findings of a survey being conducted by the Bureau of Industrial Hygiene of the New York State Department of Labor for the purpose of (1) determining the extent of the hazard from carbon monoxide poisoning in the state and the nature of the industrial processes responsible, and (2) through physical examinations of the workers determining the physiologic effects of chronic exposure to relatively small concentrations of the gas. A code of regulations can then be drawn up and measures for protection of the health of the workers be developed.

The tests for the poisoning made on

twenty-two men regularly employed in a service station are described, as well as the effect on the blood, and on pulse, respiration, and blood pressure. A typical intense headache developed in all these men which was of long duration and of a throbbing, pounding character, greatly increased by bending. Other characteristic symptoms were an ashen pallor, nausea, and considerable nervous irritability. It is suggested that the headache may be due to increased intracranial pressure from hyperemia of the large vessels of the brain.—B. A.

TOXIC EFFECTS OF ETHYLENE DIBROMIDE. *B. G. H. Thomas and W. P. Yant. U. S. Pub. Health Rep., Feb. 11, 1927, vol. 42, pp. 370–375.*

The authors made a brief series of experiments on guinea-pigs and rats which indicate that ethylene dibromide is very toxic and that precaution is necessary to obviate poisoning in its manufacture. Their conclusions are as follows:

1. The vapors of ethylene dibromide are highly toxic for guinea pigs; 0.4 per cent inhaled for 1 hour produced death within 6 to 18 hours. The minimum lethal dose was not determined.

2. Ethylene dibromide applied on the skin is highly toxic for rats; 0.25 cubic centimeters applied on the abdomen produces death within 6 to 18 hours. The minimum lethal dose was not determined.

3. Animals that die as the result of acute ethylene dibromide poisoning have a pathognomonic putrid mushroom odor at autopsy.

4. Ethylene dibromide is a general poison that produces a granular degeneration of the parenchymal tissue of the kidneys, liver, suprarenals, pancreas, spleen, and heart, and produces a swelling and degeneration of the endothelial lining of the vascular system, with a tendency toward a generalized interstitial edema.

5. The most pronounced lesion noted was that of a marked granular degeneration and disintegration of many loops of the convoluted tubules of the kidney.

—M. C. S.

DEATH OF A LOCOMOTIVE FIREMAN FROM HYDROGEN SULPHIDE FROM BROWN COAL BRIQUETTES. *H. Gerbis. Abstr. as follows from Zentralbl. f. Gewerbehyg., Feb., 1927, N.S. vol. 4, pp. 33–36, in Bull. Hyg., Aug., 1927, vol. 2, p. 626.*

Describes the train of medicolegal reasoning leading to the decision that the death of a locomotive fireman was due to poisoning by hydrogen sulphide (the potency of which was increased by the inhalation at the same time of a small proportion of carbon monoxide) given off from the brown coal briquettes used for firing. In order to avoid the risk of fire in the briquette works where the fatality occurred, the ventilator of the engine had been closed down so that a back draft was created. The symptoms ending in death in twelve hours were—pain in the chest, dyspnea, collapse, unconsciousness, and heart failure. Post-mortem (after exhumation three and one-half months later) inflammation of the lungs, characteristic dark-colored blood, flabby heart muscle brownish black in color, and bronchial irritation were found.

The briquettes contained 1.36 per cent. of sulphur. Inhalation of air containing ten parts per 10,000 of sulphuretted hydrogen gas will almost immediately cause unconsciousness and five parts serious symptoms of headache, cough, dyspnea, palpitation, and pain in the eyes.

[Artificial silk manufacture by the

viscose process gives rise to headache and conjunctivitis from minute quantities of hydrogen sulphide given off in the spinning process.]

INTOXICATION WITH COMMERCIAL METHYL CHLORIDE. *H. M. Baker. Jour. Am. Med. Assn., April 9, 1927, vol. 88, p. 1137.*

Baker reports a series of twenty-one cases of methyl chloride intoxication among men engaged in the manufacture of refrigerators, all men affected being employed in a department for testing refrigerator compressors. From a study of these cases Baker concludes that commercial methyl chloride with its probable impurities is absorbed by respiration in amounts sufficient to intoxicate workmen, unless special precautions are taken to guard against this danger; that this substance is a toxic agent which is very slowly removed from the body and therefore becomes cumulative in its action; and that it can be detected in the urine as ammonium formate before symptoms of intoxication develop. In the series of cases reported there was no injury to the optic nerve.—K. R. D.

THE INTERACTION OF A FINELY DIVIDED LEAD SUSPENSION WITH BLOOD-SERUM, RINGER SOLUTION, AND AQUEOUS PHOSPHATE SOLUTION. *J. Brooks. Biochem. Jour., 1927, vol. 21, pp. 766–776.*

What happens to colloidal lead after it is injected into the blood stream has been a matter of lively interest since this method of treating malignant disease was established. Brooks has shown definitely that the colloidal lead as well as any soluble (ionic) lead that may be present in the colloidal suspension is converted to phosphate in the blood. Colloidal lead prepared by Bredig's method was added to serum or to Ringer's solution in quantities less than the total available phosphate, the solution previously saturated with an oxygen-carbon dioxide gas mixture and, therefore, of a given hydrogen ion concentration. The gas mixture was bubbled through the liquid for from three to four minutes, ultrafiltered after a given time, and the uncombined phosphate in 1 to 3 c.c. of the filtrate estimated. The combination of the metallic lead present is necessarily preceded by its transformation into the hydroxide. The rate of combination of phosphate ions with the lead suspension was measured, and the equilibrium values obtained for the ratio of gram atoms of lead to the amount of phosphate bound indicate that the lead is converted to tertiary lead phosphate, $Pb_3(PO_4)_2$. Any lead carbonate that may be present in the suspension is also slowly converted to lead phosphate.—L. T. F.

LEAD POISONING. *C. Badham and H. B. Taylor. Studies in Indust. Hyg., No. 7, Rep. Dir.-Gen. Pub. Health, New South Wales, for 1925, Section I.—C, Indust. Hyg., pp. 52–78. Sydney, 1927.*

This important contribution is quite up-to-date to the end of 1926; knowledge on lead intoxication is brought together from all recent sources; new observations are reported; older ones are criticized; and a new method of analysis is described. It reflects credit on its authors. The presence of lead in urine is determined to an ac-

curacy of 0.005 mg. per liter by carrying down all lead in a precipitate of calcium oxalate, and finally estimating by Ivanov's sulphite reaction. The procedure for feces is to ash, dissolve the ash in hydrochloric acid, separate lead as sulphide, and finally estimate as the sulphite. Lead was found in the urine of normal persons ranging from 0.005 mg. to 0.04 mg. per liter, and in the feces from 0.05 mg. to 0.43 mg. per 100 gm.

The toxicity of lead and its compounds is discussed, and also its effect upon human tissues, in particular with regard to the production of basophilic degeneration of the red blood cells. Recent work by the Harvard Medical School regarding storage of lead in the body is followed, and three new analyses of body tissues are given. Consideration is given item by item to both the symptoms and the signs of plumbism, which so far as is possible are correlated with amounts of lead excreted in urine and feces. Standards are proposed for diagnosis of mild and of severe forms of lead poisoning.

An account is given of previous investigations into plumbism in Australia, including its occurrence among children from the dust of paint, and at the Broken Hill mines. The Broken Hill inquiry is the subject of severe, but apparently just, criticism. Details are given in appendices of a large number of analyses of urine and feces from patients certified to be suffering from lead poisoning, from patients not so certified, and from employees exposed to lead risk in an accumulator factory.—E. L. C.

INDUSTRIAL LEAD POISONING IN THE SMELTING PROCESS OF LEAD ORES. *S. D. Swope. Abstr. as follows from Southwest. Med., 1927, vol. 11, pp. 1–2, in Bull. Hyg., Aug., 1927, vol. 2, pp. 619–620.*

The author is medical officer to a large lead smelting works in Mexico where 1,000 men are employed, whose ideas upon personal sanitation are primitive. Only some of them wash annually on St. John the Baptist's Day, while their clothing usually is worn until the garments drop off their reeking bodies. In 1923 there were 882 cases of lead poisoning at the works. Medical supervision was then instituted. In 1924 there were 165 cases. In 1925 they had fallen to twenty-nine, and for the first half of 1926 there were only six cases to report. Public, hot and cold shower baths are provided; daily bathing is encouraged, although not always practised. The main prophylactic relied upon appears to be a saturated solution of magnesium sulphate.

RECENT INVESTIGATIONS INTO THE NATURE OF LEAD POISONING. *P. Schmidt. Abstr. as follows from Klin. Wchnschr., 1927, vol. 6, pp. 367–369, in Bull. Hyg., Aug., 1927, vol. 2, p. 621.*

Attention is called in this article to the importance of the early detection of lead in lead workers by examination of the blood, by chemical microanalysis, and by the use of the spectroscope, with a view to adopting prophylactic measures. Lead poisoning can by such means be detected much earlier than by clinical symptoms. The blood picture will show signs of lead two to six days after the inhalation of lead vapor, and will show it sooner when the absorption is by

the lungs than when by the alimentary canal. The red bone marrow has a capacity of accumulating lead equal to that of the liver and by its action serves as a graduated indication in the blood picture in the form of polychromatic and granular basophilic erythrocytes. The changes which normally occur in the intestines, of urobilin to bilirubin, and of hemochromogen to bilirubin and urochromin, become arrested by the action of lead. Then there is an increase of urobilin and the appearance of intermediate by-products, porphyrin and koproporphyrin, which can be detected in the spectrum.

The absorption of large quantities of lead leads to a spastic action on the vessels and the so-called lead color, which may arise without anemia, is caused in the early stage by the spastic contraction of the vessels of the face, followed by impregnation with porphyrin. To the practised eye this lead color is an important sign, especially when combined, as it often is, with a painful expression.

Professor Schmidt states that he has not changed the opinion he published in 1907 that the appearance of granular basophilic erythrocytes in the ratio of at least 100 per million is an extremely useful confirmation of lead poisoning. It is today considered that 1,000 per million shows a deep-seated condition and a liability to illness, and that 100 per million is a condition which should be carefully observed. Systematic blood examinations of lead workers are strongly recommended.

By chemical micro-analysis by the colorimetric reaction, a tenth of a milligram of lead in 100 c.c. of blood, or 1,000 c.c. of urine can be detected.

The spectroscope can be used for qualitative confirmation, but not for quantitative estimation.

For prophylactic measures great importance is laid on the selection of workpeople, the selection to be in relation to the condition of the person's blood, kidneys, arteries, and nervous system.

DEATHS FROM LEAD POISONING. *F. L. Hoffman. U. S. Bur. Labor Statistics, Bull. No. 426, Feb., 1927, pp. 45.*

The figures presented cover reports of chronic lead poisoning secured from various sources, including data from the division of vital statistics of the United States Bureau of the Census for the United States registration area, various state and city reports, and statistics secured from certain of the state industrial accident boards, as well as foreign reports.

During the period 1910 to 1924, the figures for the registration area show a progressive decrease in the number of deaths from this cause, the death rate per million of the population being 2.5 in 1910 and 1.4 in 1924. These returns are confirmed by the industrial experience of the Metropolitan Life Insurance Company for the years 1911 to 1924, and by other records which are presented.

For a study of the recent situation with regard to chronic lead poisoning, a detailed examination was made of the original death certificates representing the recorded mortality in the United States registration area during the years 1914 to 1924. There were 1,592 deaths from lead poisoning during this period, a considerable proportion of which were nonindustrial or

not connected directly with lead using industries. In the occupational group painters accounted for 841 deaths—approximately one-half of the total mortality; printers for 67; lead workers for 62, only 8 of which were deaths of persons directly connected with white lead plants; metal miners for 35; plumbers for 25; metal workers for 23; paint mixers for 15; potters and tile workers for 13—a surprisingly small number; tin and copper smiths for 9; glass workers for 9; storage battery workers for 5; and rubber workers for only 3.

A few statistics from Massachusetts, Pennsylvania, California, and New York are also presented and a useful bibliography is appended.—M. C. S.

THE DECLINE IN LEAD-POISONING. *F. L. Hoffman. Address Delivered before the Health Congress of the Royal Institute of Public Health, Ghent, 1927. Newark, N. J., Prudential Press, pp. 20.*

From his observations the author concludes that there has been a pronounced decline in the death rate from chronic lead poisoning in proportion to the total population, approximating 40 to 50 per cent. during the last decade.

With regard to fatal lead poisoning he states that this continues to affect chiefly men employed in the painting trades, but that the rate of incidence has diminished considerably and the men, as a rule, reach a fairly high average age. In the manufacture of white lead it has been reduced to practically negligible proportions, considering the extent of the industry in the United States; in the printing trades it is now no longer of much practical importance, the number of deaths annually being probably less than five among some 300,000 workmen in printing occupations; in the manufacture of electric storage batteries it is exceedingly rare, nonfatal cases, however, being relatively common; and in potteries it has been very materially reduced during recent years and is now of comparatively small importance. In potteries, as well as in printing plants and electric storage battery plants, the disease is probably proportionate y much more common in the small plants than in the larger establishments, which are adequately provided with ventilation and dust exhaustion.

With regard to nonfatal lead poisoning, Hoffman found that it occurs with a fair degree of frequency in certain lead mines of the western states, and in the manufacture of electric storage batteries. He states, however, that the incidence depends apparently to a large extent on the question of workmen's compensation, states in which compensation cannot be recovered showing a comparatively small degree of frequency, while states having liberal compensation laws show a relatively high frequency.

Aside from improvements in the industrial hygiene of lead working establishments, the main causes of the reduction in the fatal forms of lead poisoning are, Hoffman believes, the better nutrition of our workmen, the lesser frequency of gross intoxication, the shorter working hours, and improved methods of personal hygiene. He emphasizes the urgency of a clear distinction between evidence of lead absorption and evidence of lead poisoning in order that confusion may be avoided. In his opinion "the whole

question of lead absorption and lead poisoning in its industrial aspect is still open to many serious questions which can be solved only in the light of continuous and strictly impartial or disinterested scientific research."—M. C. S.

REPORT OF POISONING BY TRINITROTOLUENE AMONG ENLISTED MEN ENGAGED IN TRANSFERRING T. N. T. FROM STORAGE TO U. S. S. "NITRO." *T. A. Fortescue. U. S. Nav. Med. Bull., 1927, vol. 25, pp. 491–493.*

About half of the men engaged in transferring depth charges, mine charges, and drifting mines from a naval depot to the ship experienced mild symptoms of trinitrotoluene absorption, in spite of every precaution such as protective clothing, facilities for bathing, medical supervision, and alternation of employment. Symptoms included dizziness, pain in the chest and abdomen, cyanosis, and tachycardia. Trinitrotoluene was detected in the urine. Fumes from volatilization of the material seemed to be the cause. There was more disability among the men working in the holds than among the men on the lighters, and among the young men than among the older. There was no case of jaundice.

EXAMINATIONS OF ZINC FOUNDRY WORKERS. *Eisenstadt. Abstr. as follows from Med. Klin., 1927, vol. 23, pp. 91–92, in Bull. Hyg., Aug., 1927, vol. 2, pp. 623–624.*

The author has the medical supervision of the Oberspree zinc works, where seventy-one men are employed, and his investigations have been made with regard to these men. He has found very little sickness from lead poisoning, although the ore used contains lead, and attributes this to the works being up-to-date in hygienic arrangements and situated in healthy surroundings on the banks of the river Spree.

Of these seventy-one workmen only six were over 40 years of age, and only fourteen had been employed in the works for more than two years (one since 1915). Inquiry showed that the majority had been previously employed on healthy occupations. Six showed the lead line. Attention is called to "foundry fever" which comes on a few hours after the casting of the metal and resembles influenza with a high temperature [cf. brassfounders' ague]. Lehmann is quoted as considering this condition to be due to the toxic action of zinc on micro-organisms or cells in the body, which having been killed produce a reaction similar to that produced by an injection of protein.

The most important discovery from the periodic examinations, apart from heart rhythm disturbances, was the appearance of intermittent albuminuria, which might be positive one month and negative or quite faint the next month. Out of sixty-eight persons observed, thirteen had this kind of albuminuria. Blood pressure was found high in some men between the ages of 20 and 30 who had not albuminuria. Most of these used tobacco to excess and the pressure decreased on the discontinuance of the tobacco.

Marked lymphocytosis was found in those affected by zinc, with a corresponding diminution in the number of neutrophil leukocytes. Although

leukopenia was confirmed in a third of the cases, relative lymphocytosis remained. It was not particularly marked in young persons and usually amounted to from 30 to 50 per cent. increase of the normal.

The knowledge of the frequent appearance of lymphocytosis and albuminuria among zinc workers is of practical significance, inasmuch as false conclusions in diagnosis may be arrived at, if the special occupation of the patient is not taken into account. [See however, recent work by Lutz, and Batchelor *et al.* (THIS JOUR., 1926, vol. 8, pp. 177 and 322), which suggests that the symptoms are due not to zinc but to other ingredients in the ore; see also THIS JOURNAL, 1927, vol. 9, pp. 88, 98, and 187.]

DUST HAZARDS AND THEIR EFFECTS

THE EFFECTS PRODUCED BY THE INHALATION OF HAEMATITE AND IRON DUSTS IN GUINEA-PIGS. *H. M. Carleton. Jour. Hyg., July, 1927, vol. 26, pp. 227–234.*

Although guinea-pigs were exposed to far more massive doses of dusts than ever occurs as an occupational hazard, no definite pathologic results followed. A little bronchitis, but no fibrosis, supervened in the case of hematite dust. With iron dust in large doses, death occurred from a toxic influence; in less massive doses some bronchitis occurred, but no definite pathologic condition. These experiments do not suggest that either of these dusts constitutes a serious hazard.—E. L. C.

CONCERNING A SUGAR DUST EXPLOSION WHICH CAUSED THREE DEATHS. *C. Badham and C. F. Assheton. Studies in Indust. Hyg., No. 8, Rep. Dir.-Gen. Pub. Health, New South Wales, for 1925, Section I.—C, Indust. Hyg., pp. 79–89. Sydney, 1927.*

Details are given of an investigation into the causation of an explosion at a sugar refinery. Fine sugar dust was being cleaned out from exhaust ducts when a hand electric light bulb (carelessly used for illumination) was broken. Experiments carried out demonstrated that breaking electric light bulbs in a cloud of sugar dust caused explosions. This report is important in again stressing the explosive properties of clouds of all kinds of organic dust.—E. L. C.

AN INVESTIGATION OF CERTAIN HEALTH ASPECTS IN PERSONS ENGAGED IN THE WOOD WORKING INDUSTRIES. *D. G. Robertson. Commonwealth of Australia, Dept. Health, Ser. Pub. (Div. Indust. Hyg.) No. 4, 1927, pp. 36.*

Report is made of an inquiry into the effects of wood dust, particular regard being had to the occurrence of nasal irritation, asthma, and dermatitis. Over 200 men employed in joinery and furniture factories were medically examined; the percentage, 24, found with nasal irritation and in some cases sinusitis is held to be excessive and to indicate that wood dust is the causative agent. Nasal trouble was more prevalent where means for removing dust were inefficient. Hardwood or eucalyptus appeared to be the most

irritating timber. No undue prevalence of asthma or other affections of the respiratory system was discovered —contrary to expectation. Dermatitis was found in persons with a special idiosyncrasy; blackwood seemed most often to blame; such susceptible persons should avoid the cause of their dermatitis. The observations made are set out clearly in nine tables. A short description of woodworking machinery is given in an appendix.—E. L. C.

STEREOSCOPIC X-RAY EXAMINATION OF SANDSTONE QUARRY WORKERS. *D. J. Kindel and E. R. Hayhurst. Am. Jour. Pub. Health, Aug., 1927, vol. 17, pp. 818–822.*

The 919 men examined were all employed in the sandstone quarries of Amherst (near Cleveland), Ohio. "The composition of the stone there quarried varies from 94 to 97 per cent silica with some silicates. The industry is engaged in the quarrying of sandstone blocks and the manufacture of building stone, curbing, and grindstones." The study is summarized as follows:

1. A positive diagnosis of silicosis was made in 30 per cent of the 919 men X-rayed.
2. Two per cent showed definite evidences of a tuberculous process.
3. In this study the inhalation of silica dust among men on the job is apparently not productive of a larger than normal tuberculosis incidence.
4. The grindstone turning department presents the greatest hazard, 21 of 27 men, or 77 per cent, showing evidences of silicosis.
5. Although silicosis may appear rarely after a short exposure to dust (1 to 3 years), the great majority of cases appear after an exposure of 10 or more years.
6. Symptoms are a negligible factor as an index to the prevalence of silicosis or tuberculosis in this study as they appear equally in both the negative and positive series of cases. We do not mean, however, that they are of no value in the individual case.
7. Silicosis, in this investigation, has shown itself as a disease of slow inception, slow progress, and with hardly more than the usual relation to tuberculosis which is to be found among industrial employes generally when examined on the job.

—P. D.

REPORT OF AN INVESTIGATION IN THE ALLEGED HIGH MORTALITY RATE FROM TUBERCULOSIS OF THE RESPIRATORY SYSTEM AMONG SLATE QUARRYMEN AND SLATE WORKERS IN THE GWYRFAI RURAL DISTRICT. *T. W. Wade. Welsh Board of Health. H. M. Stationery Office, 1927.*

Considerable interest attaches to this report, the conclusions of which are based upon sociologic and industrial environment correlated with mortality statistics. Put shortly, Dr. Wade finds that in the small Gwyrfai rural district of North Wales those males who are employed in the slate industry experience a high death rate from phthisis, not experienced by other males in the district; and that this death rate occurs later in life than is usual and is associated with high death rates from other respiratory diseases. Moreover, within the industry the mortality is higher for men who dress and split slates in sheds with considerable exposure to dust than among the men who quarry the slate in the open air. These statistical characteristics suggest exposure to silica dust; and mineralogical analysis of the slate dust revealed that silica in the form of quartz particles formed

some 35 per cent., while many particles were from 1 to 5 microns in size. The conclusion seems certain that these slate workers suffer from tuberculous silicosis, even though to a far less extent than Cornish tin miners or sandstone masons. It remains for the exact extent of the hazard to be determined by dust measurements; for radiologists to detect the fibrosis in those employed; for clinicians to recognize the disease at the sanatoriums; and for pathologists to describe it postmortem in this industry.

The report contains excellent graphs exhibiting the course of the mortality from silicosis throughout life, and useful illustrations showing how slate is got and worked. It is a good example of the detection and diagnosis of an occupational disease by statistical method, rather than by clinical observation.—E. L. C.

THE LIMITED UTILITY OF DUST RESPIRATORS. *C. M. Salls. N. Y. State Dept. Labor, Indust. Hyg. Bull., July, 1927, vol. 4, pp. 1–4.*

This is a brief account with illustrations.—P. D.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

TUBERCULOSIS AND INDUSTRIAL CONDITIONS. *E. L. Collis. Tr. Thirteenth Ann. Conference Nat. Assn. Prevention Tuberc., 1927. London, Geo. Putnam & Sons, Ltd.*

Tuberculosis is an infection acquired during life; with this statement sure and certain knowledge of the disease ceases. Mortality from this cause has been falling steadily: in young adult life as real wages have risen and the food supply has become more adequate; in middle life as the effects of reducing hours of work and introducing labor saving devices have made themselves felt; in infant life, most of all, as the amount of infection in the community has diminished. The war period showed the influence of food shortage, coupled with a call for energy output, in sending up tuberculosis mortality in young adult life. The postwar period showed how this mortality may fall even when housing conditions are entirely unfavorable. Today the stronghold of tuberculosis is among males of middle age in industrial districts, the cumulative effect of industrial life of the last thirty years.

Three factors can be traced industrially which aid tuberculosis: (1) aggregation of individuals which facilitates infection; (2) alcohol which lowers general resistance to infection; and (3) silica dust which lowers pulmonary resistance to this specific infection. Control of an infectious disease can only be acquired by controlling exposure to infection. Tuberculosis is infectious. When we segregate and eliminate the infection, we shall abolish the disease. As the incidence of the disease continues to fall, sanatoriums must be devoted to this purpose.

THE TUBERCULOSIS PROBLEM IN AN INDUSTRIAL CITY. *G. B. Dixon. Abstr. from Jour. State Med., May,*

1927, vol. 35, pp. 266–277, in Am. Jour. Pub. Health, Aug., 1927, vol. 17, p. 867.

Birmingham, England, has a population of about 950,000 and is an industrial area with a variety of trades, a large number of which relate to the manufacture of metallic articles of all kinds.

Among such trades are scissor makers with a percentage mortality rate for pulmonary tuberculosis of 34.5; file makers, with a percentage mortality rate represented by 27.4; boot, shoe, and slipper makers, with a percentage mortality rate of 34.2; and brass and bronze workers with a percentage mortality rate of 27.3. The percentage mortality rate for pulmonary tuberculosis of males between the ages of 25 and 65 years, in England and Wales, for the period 1910 to 1912, was at the rate of 17.8.

Brass work is essentially a Birmingham industry. During the year 1921 the registrar's death returns for the city showed that there were 502 deaths from pulmonary tuberculosis among males of 15 years and upward, and of this number 9.2 per cent. occurred among brass workers. These numbers were the largest for pulmonary tuberculosis associated with any occupation, during the period, notwithstanding the fact that brass work, although an important section of the city's industry, was not the one giving employment to the largest number of persons.

THE INCIDENCE OF TUBERCULOSIS ACCORDING TO TRADES AND OCCUPATIONS. *Paris Letter, Jour. Am. Med. Assn., May 7, 1927, vol. 88, p. 1496.*

A statistical study on the incidence of tuberculosis according to trades and occupations has just been published by Drs. Paul Vigne, C. Gardère, and Jeannin. The personnel that cares for tuberculous patients, namely, physicians, hospital assistants and nurses, is included. In 1926, of 106 hospital externs on duty in Paris, seven were found to have tuberculosis. From 1920 to 1926, among 400 externs there were four deaths from tuberculosis. Professor Letulle had already pointed out that among the members of the religious order of St. Augustine in the Hôpital de la Charité, in the period from 1875 to 1899, of 110 deaths, eighty-two were from tuberculosis. Also the personnel employed in the laundries of Paris and its suburbs is particularly affected. Tuberculosis causes 75 per cent. of the deaths of the men and 50 per cent. of the deaths among the women. These figures are lower according as the physicians succeed in persuading families of the need of disinfecting the linen of patients before it is called for at the homes by the laundrymen.

In the industries, workmen who cut hard stones (stone cutters, polishers, building wreckers) are much exposed. A stone cutter cannot continue his trade more than thirteen years. A stone polisher rarely attains the age of 36. From 50 to 60 per cent. of the cutters of grindstones, who work in an atmosphere filled with silica dust, are tuberculous. The workers in porcelain at Limoges furnish about the same proportion. The dust from old furniture is no less dangerous. The union of the employees at the hall of public sales in Paris is 72 per cent. tuberculous. Also the workmen in bakeries have a high tuberculosis morbidity. Of 400,000 bakers in France, Barral estimates that 28,000 are tu-

berculous. In almost all the large cities, all bread to be offered for sale must be kneaded in a closed vessel. A large number of persons among the policemen are tuberculous though they live in the open air. The explanation is offered that they are exposed to inclement weather and that the police stations are generally in a deplorable hygienic condition. On the contrary, coal miners, in spite of the fact that their lungs contain deposits of coal dust, have a very low percentage of tuberculosis (from 2.50 to 3.29 per thousand), while workmen engaged in the manufacture of plaster kilns, although they breathe calcareous dust all day, enjoy a veritable immunity to tuberculosis, so that the artificial inhalation of such dust has even been recommended as a systematic treatment in this disease.—K. R. D.

SPIROCHAETAL JAUNDICE. *G. Buchanan. Med. Res. Council, Special Rep. Series No. 113. H. M. Stationery Office, 1927, pp. 64. Abstr. as follows in Bull. Hyg., Oct., 1927, vol. 2, p. 777.*

This report, while it deals particularly with the outbreak of spirochetal jaundice among the coal miners in East Lothian (which formed the basis of the author's personal investigation), contains an admirable review of the subject in general, opening with an historical survey, and dealing in succession with the clinical and pathologic features of the disease in man, the experimental disease in the guinea-pig, the characteristics of the causative organism, *Leptospira icterohaemorrhagiae*, including the methods used in cultivation and identification, the occurrence of Leptospira in wild rodents, and in natural collections of water, the methods of bacteriologic diagnosis, and the immunology of the disease. Once again, the Medical Research Council are to be congratulated on the publication of a report which brings together, in an accessible form, valuable information derived from many scattered sources.

AN OCCUPATIONAL BURSA OF THE HAND. *B. W. Rycroft. Reprinted from Brit. Med. Jour., Feb. 12, 1927, vol. 1, p. 280.*

"Many types of occupational bursae have been described from time to time. This described here is unfamiliar to me, at any rate. It occurred in a railway carriage cleaner, who had followed his occupation for seven years, the last three of which had been on piecework; it was during these last three years that he had noticed his affliction. On the dorso-medial aspect of the right thumb, opposite the metacarpo-phalangeal joint, appeared a painless swelling, semi-fluctuant, and measuring about $1\frac{1}{4}$ in. vertically by $\frac{3}{4}$ in. laterally. He was right-handed, and his method of reaching the high carriage windows was to use his left hand to steady his brush whilst his right hand supplied the motive power. Consequently, the region of most constant pressure was the angle between the right thumb and forefinger which gripped the brush. The bursa had formed over the most prominent bony point in this region—namely, the base of the proximal phalanx of the thumb. It began as a slight thickening of the skin, and not by 'blister' formation, as is met with in the hayfields.

"The patient states that five of his mates have identical swellings, though

varying in size; amongst the cleaners they are called 'pig's feet.' It is always interesting to observe the protection provided by nature for a part required to perform some special function; this, I think, is some justification for mentioning the case."

MALARIA AMONG MEXICAN COTTON PICKERS IMPORTED INTO MISSISSIPPI. *M. A. Barber and C. P. Coogle. Abstr. as follows from U. S. Pub. Health Rep., May 20, 1927, vol. 42, p. 1368, in Jour. Am. Med. Assn., Aug. 6, 1927, vol. 89, p. 480.*

The danger of malaria among temporary laborers, although varying greatly with localities and seasons, Barber and Coogle state, exists in sufficient amount to warrant attention. With the increasing scarcity of labor, it should prove of financial advantage to employers to protect imported labor against malaria.—K. R. D.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

THE CLINICAL INCIDENCE AND ASPECTS OF THE TRADE SKIN CANCERS. *R. P. White. Proc. Congress Roy. Inst. Pub. Health, Ghent, 1927.*

In this paper the writer attempts to collect, in a critical summary, the recorded examples of these malignant growths of the skin. A few are found to develop soon, sometimes immediately, after the infliction of the damage to the skin. In the majority, a neoplasm is only observed 30, 40, or 50 years after the original injury. Simple trauma, burns and scalds, friction, irritation, and the keratogenic agents are considered. Some points against the probability of heat, *per se*, being a carcinogenic agent are mentioned. Incidentally, the histopathology of the writer's "auxetic papule" is given.

The following inferences are drawn: Every skin irritant has some known special and individual physicochemical activity upon the skin. If it is absent, the agent is inert. This property should form the basis of any scientific classification of the agents which cause industrial dermatosis or lead to malignancy. How, or why, agents possessing keratogenic or auxetic properties do bring on cancer is unknown. In certain skins, hyperplasia of some of the elements takes place, which, after an indefinite latency, ends in squamous epithelioma. Apart from this group, other physical, chemical, or biotic agents are occasionally, immediately, or after an interval followed by the clinical and histologic features which are accepted as cancer. This suggests that, apart from the agent, there must be existent a cancerous state, liability, constitution, or disposition, either general or cellular. On this point most authorities appear to be agreed. In such cases, the irritant is incidental and may be provocative, but is not causal. So far as is known, cancers of the skin from the irritation of lime, chrome, common salt, and other halogen compounds, alkalies, etc., are dermatologic curiosities. From burns, scalds, or scars the onset of malignancy is casual, incidental, but probably not causal. The keratogenic agents probably, in time, can always, in certain skins, give rise to precancerous changes and are followed by a heavy incidence of epitheliomas.

Questions:—Has the rash any connection with the work? Is it independent of the occupation? Is it a simple incident or is it a consequence of labor? To what extent does the work contribute or aggravate the spread, severity, or continuance of the eruption? Age used to be regarded as a predisposing cause of occupational cancer. Length or chance of exposure are of greater import.

ECZEMA IN TOMATO PEELERS. *G. Foà. Abstr. as follows from Policlinico, May 9, 1927, vol. 34, p. 675, in Jour. Am. Med. Assn., July 30, 1927, vol. 89, p. 413.*

Foà observed eczema of the hands in children and young women employed in factories canning tomatoes. He attributes the eczema to the citric acid and succeeded in preventing it by advising the workers to dip their hands from time to time in a vat containing a 1 per cent. solution of sodium hydroxide and then in water. —K. R. D.

DERMATITIS VENENATA IN THE RUBBER TIRE INDUSTRY. *D. E. H. Cleveland. Abstr. as follows from Canadian Med. Assn. Jour., June, 1927, vol. 17, p. 695, in Jour. Am. Med. Assn., Aug. 27, 1927, vol. 89, p. 724.*

Hexanitrodiphenylamine was responsible for the poisoning in Cleveland's case. Hexanitrodiphenylamine (known colloquially in the factory as "hex") is a powder, readily conveyed through the air, which produces its effects on the face and on the parts covered by dusty sweat-soaked clothing.—K. R. D.

STUDIES ON LACQUER DERMATITIS. III. DERMATITIS PRODUCED BY CHINESE LACQUER. *I. Tôyama. Japan. Jour. Dermat. and Urol., 1926, vol. 26, English summary pp. 51–55, (in Japanese pp. 927–936).*

STUDIES ON LACQUER DERMATITIS. IV. THE HISTOPATHOLOGY OF LACQUER DERMATITIS. *I. Tôyama and T. Usuba. Ibid., English summary pp. 56–57, (in Japanese pp. 937–946).*

Abstracted as follows in Bull. Hyg., Nov., 1927, vol. 2, p. 868.

Part III.—There is a strong reason to suppose that the lacquer tree is not indigenous to Japan. It is probably an imported specimen of the *Rhus vernicifera* D. C. of China. It grows wild in the latter, but not in the former country. According to the author, records of its artistic employment in China date from 2640 B.C.; in Japan from 392 to 291 B.C. Today much the larger proportion of the local consumption of lacquer in Japan is a Chinese product. For this reason it may be stated that the chief cause of dermatitis from handling the boxes of "mah jongg" sets is due to Chinese lacquer.

The poisonous principle is "urushiol." Raw Chinese lacquer contains approximately between 70.02 per cent. and 36.88 per cent. In the Japanese variety it is somewhat larger. Experimentally, a drop, the size of a pinpoint, diluted ten times in olive oil, applied to the skin, brings out in seven hours erythema and edema. With the Chinese product, this does not appear until the following day. Moreover, the inflammatory condition always remains less severe. With either substance, papules and vesicles usually form. The fresh lacquer is always the more virulent. Thorough

dryness and oxidation remove the danger of dermatitis. Industrial lacquer dermatitis is of great antiquity in China, although the rashes it produces were often mistaken for other skin diseases. Treatment of this complaint seems to have been first described between the years A.D. 281 and 361.

Tôyama next proceeds to discuss the differences between this dermatosis and those of *Rhus toxicodendron*, *venenata*, and *diversiloba*. In the latter cases he says: The heart's action and arterial tension are increased, dyspnea and even congestion of the lungs may be present, together with other general symptoms. No cases of serious complications are known to have followed external poisoning by either Chinese or Japanese lacquer. On the other hand, three fatalities after external exposure to *Rhus*, in North America, are known.

For the bibliography we are referred to the complete paper written in Japanese.

Part IV.—After the application of crude Japan lacquer (Ki-urushi), or its active principle (urushiol), to three susceptible persons, several pieces of skin were removed and examined.

The first statement of this extract is perhaps a little difficult to reconcile. "In the earliest stage, namely, two hours after the application of the lacquer, there was along with the destruction of the sebaceous glands a serous exudation, or formation of vesicles, immediately beneath the horny layer, without any remarkable histologic change in the lower epidermal layer or in the corium." A few hours later, this is replaced by a marked edema. This spreads widely, involving the deep epidermal papillary and subpapillary tissues. The vessels dilate and become surrounded by emigrant cells. At this time the skin appears red, but there is no itching. Everywhere the prickle cells get separated, the intervals become filled with leukocytes and thus the vesicles are formed. The horn cells become ill-formed and eosinophils appear in large numbers in the epidermis, corium, and vesicles.

The poison of Japan lacquer is very soluble in fat, but does not destroy the cells. In one case only, after the application of a strong extract, continuously for twenty-four hours, was necrosis of the prickle cells observed. The inflammatory symptoms begin to subside in about five days' time.

Three figures are given in the original article.

LINSEED OIL DERMATITIS. *F. J. Vokoun. Jour. Am. Med. Assn., July 2, 1927, vol. 89, pp. 20–21.*

Dermatitis is very common among workers in linseed oil mills. The areas affected are those which come in contact with the oil, usually the anterior aspects of the arms, the dorsa of the hands, and the anterior aspects of the thighs. The lesions are symmetrical, discrete, deep, and thickly scattered, and consist of primary macules and papules with secondary scratch marks and crust formation. The symptoms are intolerable itching and burning, especially at night or after bathing. Indian or South American seed is a more potent cause of the disturbance than Canadian or American seed.—K. R. D.

LINSEED OIL DERMATITIS. *F. J. Vokoun. Ohio State Med. Jour., March, 1927, vol. 23, p. 229.*

RIEHL'S MELANOSIS, OIL PAPULES, AND FOLLICULAR HYPERKERATOSIS IN A METAL LATHE WORKER. *Sezary, Pasteur, Vallery-Radot, and Benoist. Abstr. as follows from Bull. Soc. franç. de dermat. et syph., 1927, vol. 34, p. 139, in Arch. Dermat. and Syph., Aug., 1927, vol. 16, p. 206.*

There was reticulated pigmentation of the face, oral mucosa, and trunk, and follicular lesions on the trunk, arms, and forearms. Signs of internal glandular disturbance were not found, nor had arsenic been administered.

MELANOSIS IN A RAILROAD GRADE WORKER WHO HANDLED TIES TREATED WITH CREOSOTE. *Hudelo, Rabut, Cailliau, and Mornet. Abstr. as follows from Bull. Soc. franç. de dermat. et syph., 1927, vol. 34, p. 144, in Arch. Dermat. and Syph., Aug., 1927, vol. 16, p. 206.*

This case presented the clinical and histologic features of pigmented reticular poikiloderma or Riehl's melanosis. The face, forearms, and hands were especially affected, the ventral and lateral surfaces of the trunk and the labial and buccal mucosa being less markedly involved. There was no hematoporphyrinuria, and the patient's general health was good. He had been handling the ties for a year, and the pigmentation was of several months' duration.

CLINICAL FEATURES, PATHOGENESIS, AND TREATMENT OF TURPENTINE DERMATITIS. *A. Perutz. Abstr. as follows from Arch. f. Dermat. u. Syph., Dec. 31, 1926, vol. 152, pp. 617–652, April 23, 1927, vol. 153, p. 256, in Bull. Hyg., Nov., 1927, vol. 2, p. 869.*

This paper is an elaborate discussion of the nature of the exciting cause of turpentine dermatitis, *i.e.*, whether it is internal (constitutional, allergic, anaphylactic), or external (local), or both. Fifteen cases are very fully described. These the author divides into three main types: (1) the very acute, (2) the subacute, and (3) the chronic.

Everything, in his opinion, points to the acute form being allergic, *i.e.*, the hypersensibility is the result of two factors: (*a*) an inherited tendency to sensitization, and (*b*) the external exciting agent bringing it about. The subacute is a combination of the resulting specific skin changes, and the chronic form leaves behind all the allergic conditions to degenerate into a chronic eczematous state. The spontaneous disappearance of the specific factor by which the allergic condition degenerates as described is due to slow desensitization, *i.e.*, it is an expression of the skin's acclimatization to the injurious substance.

The incubation period lasts ten to twenty days. Relapses, in Pirquet's sense as analogous to increased sensibility to serum sickness in the case of the reinfected, come on in two or three days.

He adduces many experiments to show the specificity of turpentine: (*a*) by causing local reaction on the healthy skin under a bandage; (*b*) severe relapse when turpentine was applied to healing cases which was not so in healing dermatitis from other causes; (*c*) local reaction from application of unsaturated polyterpenes.

OCCUPATIONAL ECZEMA. *E. Weil. Abstr. as follows from Zentralbl. f. Gewerbehyg., March, 1927, N. S. vol.*

4, pp. 84–88, in Bull. Hyg., Nov., 1927, vol. 2, pp. 866–867.

A summary—very useful to dermatologists and those interested in industrial medicine—of 144 cases of occupational eczemas which had occurred over a number of years in the Skin Clinic of Prof. Karl Herxheimer, of the University of Frankfurt a. M. They occurred in two sharply divided classes: (1) those occurring at an early stage of contact with the irritating substances which, therefore, find a parallel in the anaphylactic state, and (2) those occurring late, after years, it may be, of contact in which a slow sensitization of the epidermis to the substances has been brought about.

Dr. Weil considers that anaphylactic constitutional diathesis plays an almost negligible part in occupational dermatitis except in the well-known reaction to plants among gardeners and others, of which she mentions some fifty varieties (Primulas, etc.). She attaches (see Table 1) a rough but practical classification of the cases described with the number in her list attributable to each one.

TABLE 1

CAUSE OF INJURY	TYPICAL EXAMPLES	NO. OF CASES
A. Physical	Metal dust and metal work	14
B. Chemical, and especially:		
i. Acids	Citric acid eczema in lemonade factories	15
ii. Alkalies and corrosive substances	Cement eczema through corrosive action of the lime	20
iii. Metaloids	Artificial manure eczema from arsenic	3
iv. Metals	Cobalt eczema in a gilder	4
v. Salts	Eczema from common salt (vendors of herrings)	19
vi. Crude oil	Tar eczema	25
vii. Tar derivatives	Aniline workers' eczema	18
viii. Varnishes and lacquers	Turpentine eczema among polishers and painters	9
ix. Alkaloids	Quinine eczema among quinine workers	4
x. Other organic compounds	Eczema in sugar refineries	9
C. Anaphylactic reactions (of plant origin)	Asparagus eczema in fruit preserving factories	8 (but many others cited)
D. Living excitants	Eczema in dock laborers from mites in dirty cotton wool	4

SKIN DISEASES. *Ann. Rep. Chief Inspect. Factories for 1926. H. M. Stationery Office, 1927.*

The medical section of this report is written by Dr. Bridge, the senior medical inspector. It shows the increasing importance attached by the Home Office to the industrial dermatoses. Sir Thomas Legge who has just retired was the first to emphasize the necessity for an official investigation and report upon these cases. Other nations now follow this example.

In England, apparently, the only dangerous exposure to arsenic occurs in the manufacture of "arsenical sheep dip." In two instances, definite cancer of the skin with secondary growths was found; also two other separate cases of simple dermatitis. Of the 38 examples of anthrax known, 3 died. Wool, horsehair, and hides and skins were the chief sources of infection. The 55 cases of ulceration from chrome were spread over a number of trades. The making of bichromates claimed 2, dyeing and finishing 33, chrome tanning 2, French polishing 7, the making of chrome colors 5, other industries 6.

During the year 1926 the distillation products of coal and petroleum have claimed the heavy incidence of 187 cases of malignant ulcerations, of which 49 were fatal. Of the causal agents pitch was responsible for 49, tar for 27, paraffin for 2. The remaining 109 were brought about by oil; 35 of these died. This class of skin disease has been compulsorily notifiable from the year 1920. Since this enactment 637 cases have been reported, with 138 fatalities.

The 429 cases of dermatitis noted during the year 1926 is a record. Baking and confectioner's flour were believed to be responsible for 49 and biscuit making for 12. A further inquiry into this condition is now taking place. In the creaming and icing departments of this last industry 28 cases of dermatitis were found by Dr. Overton. Soda holes are common among workers in the caustic soda department of alkali plants. Of the total number of dermatoses recorded during the year 12.1 per cent. were due to the use of alkalies chiefly required as cleaning agents. Of the "painters" and "preparers" employed in a large municipal tramway works, 21 per cent. were discovered to be suffering from the effects of "American turpentine" made by the steam distillation process. Hexamethylenetetramine, used as an accelerator in the vulcanizing of rubber, accounted for 3 cases of dermatitis out of the 7 reported in this trade. In the making of hats 5 persons were notified to be suffering from inflammation of the skin due to their work.—R. P. W.

INDUSTRIAL EYE INJURIES. *J. B. Stanford. South. Med. Jour., May, 1927, vol. 20, p. 398.*

RAILWAY OPHTHALMOLOGY. *J. V. Clothier. Northwest Med., July, 1927, vol. 26, p. 356.*

PROTECTING THE EYES OF CHEMICAL WORKERS. *J. E. Hannum. Indust. and Engin. Chem., July, 1927, vol. 19, pp. 817–819.*

Eye injuries in the chemical industry most frequently result from burns caused by splashing acids and caustics and from the effects of such poisons as methanol, lead, nitroglycerin, ammonia, and nitrobenzene. First aid treatment for the most common acid burns is suggested and the poisons which constitute serious hazard to the eyes are listed, with the effects they produce. It is pointed out that exposure to inorganic dusts may also be dangerous.

The natural objection among workmen to wearing goggles can be overcome by comfortable adjustment of the goggles to the face of the individual man, by providing the goggles with lenses which correct the eyes when correction is needed, and by education of the workman, foreman, and executive.

At least one-tenth of the two million annual industrial accidents in the United States result in injuries to the eyes; in Pennsylvania during the years 1916 to 1924, about 40 per cent. of total compensations for all classes of permanent injuries were awarded for injury to the eyes. Persistent and united effort can secure a substantial reduction in these figures.—M. G. P.

MINERS' NYSTAGMUS. *J. S. Haldane and T. L. Llewellyn. Brit. Med. Jour., July 2, 1927, vol. 2, p. 37.*

The writers reply to an attack upon the finding that the essential cause of miners' nystagmus is defective lighting. They point out that electric hand lamps often give less light than old oil safety lamps, and much less than improved oil lamps. Electric cap lamps are entirely effective in preventing the disease in America; they keep the illumination in the right place. No attack on the light theory of origin is useful which is not supported by photometric observations.—E. L. C.

MINERS' NYSTAGMUS. *G. Wilson. Brit. Med. Jour., July 2, 1927, vol. 2, p. 37.*

A pit is cited where no nystagmus was known for seventy years while worked by naked lights. Gas ignition led to installation of safety lamps in 1908; in 1913 a case occurred. In 1916 naked lights were reverted to and no case has occurred since. Nevertheless, the author advances the theory that miners' nystagmus is due to mental conflict in an individual who fears and would escape from his occupation: he compares it to "shell shock." No reason is given why the miner chooses nystagmus as his form of shell shock and is able to make his eyeballs oscillate involuntarily, or why the soldier in the trenches did not choose nystagmus as his form of shock.—E. L. C.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

INDUSTRIAL ACCIDENTS IN ARSENALS OF ITALIAN NAVY. *G. L. Rolando. Mil. Surgeon, Jan., 1927, vol. 60, p. 65.*

INCREASE IN WORKMEN'S ACCIDENTS. *Jour. Am. Med. Assn., June 4, 1927, vol. 88, p. 1820.*

The state Bureau of Workmen's Compensation reports that there was an increase of 2.3 per cent. in the number of accidents in Pennsylvania during 1926 over the preceding year. The total number of accidents was 180,420. There were 2,136 fatal accidents, the greatest number from any one cause (484) being from anthracite mining. The Bureau's summary of the operation of the law during the last eleven years shows that the average annual number of deaths was 2,469, and the average annual nonfatal cases 181,198. The employers and their authorized insurance carriers incurred during this period a total liability of $121,655,455 due to accidents. The average award for death in the eleven years was $3,390. There were 6,245 eyes lost with an average compensation per case of $1,422; 2,573 hands, with

an average compensation of $1,840; 821 arms lost, average compensation, $2,223; legs lost totaled 1,078, average compensation, $2,250, and feet lost totaled 1,505 with an average compensation of $1,691.

INDUSTRIAL ACCIDENT PREVENTION. *C. G. Ingall. Abstr. as follows from Jour. State Med., June, 1927, vol. 35, pp. 360–365, in Bull. Hyg., Nov., 1927, vol. 2, pp. 884–885.*

Some description is given of the objectives adopted by the National "Safety First" Association which comprises 400 firms holding the opinion that accidents can be prevented by education. Only a minor percentage of accidents are due to mechanical means; the human factor accounts for more than 70 per cent. Domestic or financial trouble, gambling, and intemperance may be at the back of any accidental occurrence. A man, afterwards found to be suffering from a serious complaint, collapsed and fell while building a roof. A skilled fitter lost three fingers due to his attention being diverted by his wife's serious illness and the fact that his five young children were left unsupervised at home. Eagerness to see early news of racing results may lead to inattention. Only by constant education, brought in an attractive way before the workers, is the improvement to be effected.

Results follow: One firm reduced accidents from 92 in 1915 to 15 in 1921. Another firm reduced their compensation payments between 1919 and 1922 by over 50 per cent. In another case in eighteen months the number of septic cases reported fell from 17.8 per 100 cases to 1.4. While in Admiralty dockyards an approximate reduction of 25 per cent. of compensation paid on all classes of accidents was obtained in the first year. The efficiency first aid equipment must not be neglected. Education can do much, but environment and living conditions both play their part in the causation of accidents.

INDUSTRIAL SURGERY

RELATION OF RAILWAY SURGEON TO PERSONNEL AND OPERATING DEPARTMENTS. *W. E. Williams. Texas State Jour. Med., Feb., 1927, vol. 22, p. 640.*

FIRST AID IN RAILWAY SURGERY. *R. W. Knox. South. Med. Jour., March, 1927, vol. 20, p. 228.*

RAILROAD AND INDUSTRIAL SURGEON. *A. P. Howard. Texas State Jour. Med., April, 1927, vol. 22, p. 759.*

BACK INJURIES IN INDUSTRIAL EMPLOYEES. *R. F. Herndon. Abstr. as follows from Jour. Bone and Joint Surg., April, 1927, vol. 9, p. 234, in Jour. Am. Med. Assn., June 18, 1927, vol. 88, p. 1993.*

Herndon has made a study of 941 consecutive cases of back injuries in industrial employees. Sprain occurred in 498 cases. About two-thirds of the cases were located in the lumbo-sacral region. In about 11 per cent. the condition seemed to be localized about the region of the sacro-iliac joint. The next most frequent site was the middle and upper lumbar regions, where about a fourth of the cases occurred. Contusions occurred

in 122 cases. Fracture of the vertebral processes occurred in forty-one cases. In thirty-six cases the fracture involved one or more of the transverse processes. In about half of these the fracture was due to abnormal muscular pull, and in about half to direct violence. Fracture of the vertebral bodies occurred in thirty cases, or 3 per cent. Many of these followed what seemed to be slight accidents, and were surprisingly devoid of symptoms. Chronic deforming arthritis was found in 107 cases. A neurosis was diagnosed in eleven cases. Malingering occurred in thirty-five cases. In ninety-seven cases, the condition of the back and the symptoms complained of seemed entirely attributable to disease. Variations in the spine from the normal or textbook anatomy occurred in 4.8 per cent. of the cases in the lumbosacral region. The most common anomalies were split spinous processes, usually of the first sacral vertebra, and sacralization of the fifth lumbar vertebra.—K. R. D.

TREATMENT OF ACID AND ALKALI BURNS. *E. C. Davidson. Abstr. as follows from Ann. Surg., April, 1927, vol. 85, p. 481, in Arch. Dermat. and Syph., Sept., 1927, vol. 16, p. 337.*

Experiments made by Davidson indicate that the treatment of acid and alkali burns by washing the burnt area thoroughly with plain water is superior to neutralization. When treatment by neutralization is employed, it should be used only after the maximal amount of the caustic has been removed by thorough washing.

ELECTRO-PHYSIO-THERAPY IN INDUSTRIAL WOUNDS. *F. H. Walke. Arch. Physical Therapy, X-Ray, Radium, April, 1927, vol. 8, pp. 178–186.*

The author presents the technic and methods which have proved successful in the treatment of wounds of the soft parts of the body; of injuries to muscles, nerves, and tendons; of bone injuries which are slow to heal; of joint injuries; of sacro-iliac strain; and of injuries to the skull. It is his opinion that electrophysiotherapy "has found its place in industrial surgery. The outcome of many cases depends upon its intelligent use, and results are obtained that could not be achieved by any other known method. Its success or failure at the hands of industrial surgeons depends entirely upon their accurate knowledge of the physics of the modality used, and their application of the correct treatment to the case at hand. Then will it have passed the experimental stage, and be relied upon to produce certain, specific and gratifying results."

An interesting discussion follows the paper.—M. C. S.

WHY INDUSTRIAL SURGERY IS A SPECIALIZED FORM OF SURGICAL PRACTICE. *G. W. Hawley. Jour. Am. Med. Assn., June 4, 1927, vol. 88, pp. 1775–1778.*

Hawley stresses the necessity of measuring surgical results in terms of recovery of function, not merely in terms of satisfactory healing of an injured part, and urges the importance of treating patients psychologically as well as surgically. More effort should be made, in the author's opinion, to educate patients and the public as to the difference between roentgen ray

and functional deformities, and the importance of function over internal form. He concludes with a plea for the organization of a profession of industrial surgeons who can offer their services to all corporations, both large and small, remaining free and independent to serve one or many, not as officials, but as their services are required.—K. R. D.

INDUSTRIAL SURGERY. *W. H. Rose. Boston Med. and Surg. Jour., June 9, 1927, vol. 196, pp. 933–941.*

The history of compensation legislation is reviewed, starting from the German Employers' Liability Law, 1871. Enactments begun in the United States in 1908 have since spread to forty-two states, so that today some states, *e.g.*, Massachusetts, are ahead of other countries in the matter. Industrial surgery has been developing along with, and partly in consequence of, compensation legislation. Hand labor claims 43 per cent. of accidents. Workmen themselves are responsible for about 75 per cent. of all accidents; fully 80 to 90 per cent. can be eliminated by proper organization. The American steel mills are today the safest in the world, having an accident rate of ten per thousand employed, compared with seventeen per thousand in Germany.

A committee on traumatic surgery, appointed in 1926 by the American College of Surgery, has made certain recommendations, including a scheme for rehabilitating the partially incapacitated and provision for consultation facilities. The "curative workshop" is advocated and is well developed in Milwaukee.

WOMEN AND CHILDREN IN INDUSTRY

THE PHYSIQUE OF WOMEN EMPLOYED IN INDUSTRY. *E. P. Cathcart. Jour. School Hyg. and Physical Education, 1927, vol. 19, pp. 136–143.*

A short, but unusually interesting, account is given of the collection of physical data from industrial employed and unemployed women and from college students and of deductions drawn therefrom. The employed women were found with an approximate weight of 109 pounds, a height of 62 inches, a pull of 183 pounds, a grip of 58 pounds, and a crush of 50 pounds. The unemployed had poor physique and apparently on this account failed to attract those engaging labor. Those employed on heavy physical work had more perfect forms and greater grace in carriage than others; but the students stood out by themselves for physique and strength. Close co-ordination was found between mental alertness and physique; apparently development of either advantages the other—a conclusion the importance of which is hard to overestimate.

Grip increased little after age 16; height became steady between ages 17 and 18; pull and crush at age 18; weight became steady at age 18 but rose again after age 30. Judged by height measurements a bench for women standing at work should be about 37 inches. The strength-weight ratio of employed women was about 2.66, of unemployed 2.38, and

of college girls 2.88; a ratio below 2.5 may be taken as a fitness factor below which hard factory work is unsuitable.—E. L. C.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

NOTES ON THE DEGREE OF COMFORT PRODUCED BY ADMITTING WITH THE PLENUM AIR OF A THEATRE A MIXTURE OF OZONE AND AN ESSENTIAL OIL VAPOUR. *C. F. Assheton. Studies in Indust. Hyg., No. 9, Rep. Dir.-Gen. Pub. Health, New South Wales, for 1925, Section I.—C, Indust. Hyg., pp. 90–96. Sydney, 1927.*

The following conclusions are given, drawn from experiments, personal experience, and the opinions of colleagues and members of the audience at the Crystal Palace Theatre:

(1) There is a distinct absence of the usual body odours, &c., met with in crowded buildings.

(2) From inquiry there seems to be general consensus of opinion that this absence of body odours both on hot nights when the fan has been full on and on cooler nights when the air supply is less has produced a greater degree of comfort in the theatre.

(3) There is a distinct smell of thymol, but the concentration is not strong enough to be objectionable. In fact, from my own experience and the result of my inquiries, I should say that it was more or less pleasant and certainly never oppressive. One notices the smell distinctly on entering the theatre, but gradually becomes accustomed to it.

(4) The experiments indicate a possible reduction in the bacterial content of the air due to the ozone-oil mixture, although more work will have to be done both to determine this and the actual ozone content of the air.

(5) There have been no complaints of sore throats.

(6) With the three factors, dry and wet bulb temperature and air movement, which affect physical comfort, there may be a fourth one due to odours which, although perhaps harmless in themselves, do produce a sense of discomfort.

(7) The distinct absence of these unpleasant odours with this plant in operation is, to my mind, a primary argument in favour of such an installation.

(8) The method is worthy of a more detailed investigation.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

THE ORGANIZATION OF A FACTORY CLINIC. *N. H. Mummery. Abstr. from Proc. Roy. Soc. Med., April, 1927, vol. 20. pp. 817–823 (Epidem. and State Med., pp. 41–47), in Bull. Hyg., Aug., 1927, vol. 2, p. 635.*

The number of factory clinics in Great Britain is not great. Hence description is given of the organization of one served by the author, where an average staff of some 6,000 employees is provided for. A factory clinic should be part of the organization of the welfare department, and its medical officer should be an expert adviser to that department, and not become an administrative or executive official. Some description is given of the layout of the premises which may be used.

The attendance of an ophthalmic

surgeon at stated hours is of great advantage. With a sufficient staff of nurses, a trained masseuse, and dentists, a single medical man, acting whole time, can meet the calls made upon his time for a factory of the size mentioned above, in examining all applicants for work, seeing those returning to work after sickness, as well as supervising the treatment of minor injuries and medical cases. Economy in time lost is achieved by treating at the factory all slight injuries, and also most skin cases, for which supervision of special treatment is advisable. A factory clinic can and should give greater individual attention more quickly than is possible at hospitals or panel surgeries. Moreover its duty in restoring the worker to his work is definite and clear. After-care to see that economic use is made of restored function can be carried out. Thus, labor wastage is limited, production is increased, while costs of insurance premiums are lowered. Records are given showing how, at Christmas time when a seasonal rush of work occurs, for which casual labor is employed, the work of the clinic at Cadby Hall is nearly doubled, to fall again in January when the untrained staff are no longer employed. The costs of the clinic are not kept separate from those of the welfare department, but the saving it effects is to be read in reduction in the amount of absenteeism, in wages earned, the output of production, and lessened premiums for employer's liability.

The author stresses the fact that, in examining workers for employment, the object was not to reject applicants, but to find suitable employment for each according to his capacity. No difficulty has been experienced in carrying out this branch of the work.

HEALTH PROBLEMS OF THE TEXTILE INDUSTRY. *R. P. Knapp. Nation's Health, April, 1927, vol. 9, pp. 17–20, 76.*

Every applicant for employment in Cheney Brothers, silk manufacturers, is given a thorough medical examination, and, if passed, is fitted to a job deemed suitable from the results of the examination. Beside facilities for first aid, there are dental, X-ray, and physiotherapy departments; also a tuberculosis clinic is maintained and developed cases are sent to one of the state sanatoriums. A periodic physical examination is extended to everyone in the plant but stressed particularly for executives and foremen. Then by posters, health hints on pay envelopes, talks to foremen, etc., the gospel of preventive medicine is preached.—M. M.

VOLUNTARY MEDICAL EXAMINATION AN INDUSTRIAL SUCCESS. *Nation's Health, April, 1927, vol. 9, pp. 49–50.*

The A. O. Smith Corporation in Milwaukee, Wis., offers on a purely voluntary basis a complete physical examination to its employees and their families without restriction or cost. The men are not urged to be examined and the usual means of publicity through the plant publication are not resorted to, yet one-fourth of about 4,500 employed have taken advantage of it. Fluoroscope and X-ray examinations are included, after which there is a conference on the findings. No treatments are given except in the dental department and these are limited to prophylaxis and

extraction. The company, regardless of whether such work can be evaluated monetarily, is satisfied that a superior type of health service is being rendered its workers.—M. M.

NEW JERSEY HEALTH SERVICE FOR INDUSTRY. *B. S. Coleman. Abstr. from Health Bull., N. J. Tuberc. League, May, 1927, vol. 9, pp. 3–8, in Am. Jour. Pub. Health, Aug., 1927, vol. 17, pp. 868–869.*

The Industrial Health Service of the New Jersey Tuberculosis League undertook a preliminary survey of existing medical facilities in the plants of Newark. This survey showed that only 41.7 per cent. of them had any sort of medical service and the majority of those had only a physician on call. In other words, the greater number of factories had no medical supervision to speak of.

After the survey was made, the proposed program of the health service was outlined to both employers and employees in a series of talks given in the factories either during the noon hour or on factory time. The majority of employers were anxious to have the message placed before the workers in the best possible manner, and so company time was granted. Short talks on the value of the periodic health examinations were generally accompanied by charts and motion pictures. At the close of the talk how many employees wanted an examination was ascertained and, if a nucleus of twenty-five or more responded, a clinic was established in the factory. In the talks, great care was taken to emphasize the confidential nature of the examination as well as the fact that the examinations are voluntary. It was explained that there would be male physicians for the men and female physicians for the women. This is most important. Even though the examinations are confidential between the examining physician and the employee, and they were not instituted with the idea of apprising the employer of the condition of his employees, the employee himself often went to his employer with the results of the examination.

MEDICAL EXAMINATIONS AND WELFARE IN ENGLISH COTTON FACTORIES. *W. F. Dearden. Abstr. from Jour. State Med., May, 1927, vol. 35, pp. 249–258, in Am. Jour. Pub. Health, Aug., 1927, vol. 17, p. 867.*

Welfare departments are now becoming a prominent feature in cotton factory administration, and where they are in vogue it is proving to be a distinct advantage to place in the hands of the welfare supervisor the first selection of those under 16 years of age, and in some cases of those under 18 years of age, who seek employment. The certifying surgeon is brought into close touch with this official when visiting the factory to carry out his own part in the selective process.

Indeed this association between medicine and welfare is proving of such value at many cotton factories that the respective managements have deemed it an advantage to make special arrangements with the doctor to extend his functions beyond the statutory limit.

The author discusses medical examinations in some detail as well as the conditions in cotton manufacturing processes which tend to affect adversely the health of the operatives.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

A Study of Telegraphists' Cramp. *M. Smith, M. Culpin, and E. Farmer. Indust. Fatigue Res. Board, Rep. No. 43. H. M. Stationery Office, 1927, pp. 40.*

This report deals with an investigation made into telegraphists' cramp, mainly from its psychoneurotic aspect. It is, however, more than a discussion of one occupational disability, as it exhibits how this or that trade neurosis may be the expression, in a group of persons constituting about 20 per cent. of the population, of relatively unstable emotional reactions. The cramp group reacted to certain well-devised tests, on the average, differently from most persons; they exerted more pressure on the keys when sending messages than others, but others when speeded up also tended to use more pressure; they were less efficient to ergograph tests; and they produced a poor record to the McDougall-Schuster dotting test. While the average reactions of the cramp group were as stated, these tests did not pick out with certainty individual cases. The group exhibited an unusual prevalence of psychoneurotic symptoms, associated with susceptibility to muscular fatigue, poor ability for performing quick and accurate movements, and incomplete control over muscles. The proposition is advanced that such persons, in any occupation, would tend to have a "nervous breakdown" which would express itself as an occupational neurosis if the occupation subjected them to any constant strain. Prevention lies in excluding such persons from occupational strains and in removing such strains when possible. Treatment must be concerned with the emotional state of the patient as well as with the localized disability.—E. L. C.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

Workmen's Compensation Law, with Amendments, Additions and Annotations to August 1, 1927. *N. Y. State Bur. Statistics and Information, pp. 137.*

Compensation for Injuries Due to Industrial Diseases. *A. Langelez. Bruxelles-Méd., Aug. 7, 1927, pp. 1293–1296.*

The author describes the salient points of a new law which has just come into force in Belgium granting compensation for industrial diseases. It is based on experience gained from other European countries. An expert medical committee fixes the list of diseases (which at present includes only poisoning by lead and by mercury, and anthrax) and the industries concerned. The claimant obtains a medical certificate to support his claim; but medical men are not called upon to notify cases. Medical inspectors of industry, of whom Dr. Langelez is one, then examine the patient and report. Employers, if engaged in a scheduled industry, are

not permitted, as in the case of accidents, to insure against their liability, but are called upon to contribute to a fund from which compensation is paid to authentic cases. It is hoped in this way to stimulate employers to interest themselves in the prevention of diseases. Compensation may be awarded for death, or for permanent partial or total incapacity, or for temporary total incapacity lasting for at least fifteen days.—E. L. C.

INDUSTRIAL ACCIDENTS AND ACCIDENT NEUROSIS. *H. Seelert. Abstr. as follows from Deutsch. med. Wchnschr., 1927, vol. 53, pp. 416–417, in Bull. Hyg., Aug., 1927, vol. 2, p. 631.*

A comment by the professor of psychiatry and nervous diseases in the University of Berlin on a decision of the courts declaring that "accident neurosis," "accident hysteria" or the belief of a workman that the effect of an accident has been to render him permanently ill and unable to resume work, should not be decided in favor of the workman.

Seelert discusses this decision, considering it generally sound. He would support the view that a claim for compensation should not be upheld if the medical examination, and the nature of the complaints of the insured person as to his disability, point to the effects of a psychologic reaction arising out of the position of the insured in relation to the recollection of the accident.

THE QUESTION OF COMPENSATION IN THE SO-CALLED ACCIDENT NEUROSES. *H. Kleist. Abstr. from Klin. Wchnschr., 1927, no. 28, in München. med. Wchnschr., Aug. 5, 1927, vol. 74, p. 1341.*

INHIBITION OF WORKING ABILITY BY UNCONSCIOUS DISTURBANCE OF THE WILL TO WORK. *E. Beyer. München. med. Wchnschr., July 15, 1927, vol. 74, pp. 1181–1182.*

THE RECENT DECISION OF THE IMPERIAL INSURANCE BOARD ON ACCIDENT NEUROSIS. *Hoch. München. med. Wchnschr., Sept. 2, 1927, vol. 74, p. 1507.*

REHABILITATION OF DISABLED EMPLOYEES

EMPLOYMENT FOR THE HANDICAPPED (SUPPLEMENTARY LIST). *F. W. Jenkins. Russell Sage Foundation Library Bull. No. 84, Aug., 1927.*

This selected bibliography supplements Library Bull. No. 21, Feb., 1927.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

INTERNATIONAL LIST OF CAUSES OF DEATH. *Am. Jour. Pub. Health, Sept., 1927, vol. 17, pp. 887–894.*

This article presents a summary of the work undertaken by the Health Organization of the League of Nations in preparing revision of the International List of Causes of Death. The various lists under discussion are given.

INDUSTRIAL MORBIDITY DATA AND THE PHYSICIAN. *C. O. Sappington. Am. Jour. Pub. Health, July, 1927, vol. 17, pp. 711–713.*

This paper is summarized as follows:

Industrial health supervision provides exceptional opportunities for the collection and analysis of morbidity material which is otherwise practically unobtainable. It is only through the careful measurement of this experience that we shall provide a rational basis for the inauguration of changes which must come if progress is to be made in industrial hygiene.

Up to the present time, attention has been concentrated mainly upon accident experience. More thought and effort should be put upon the collection and analysis of material based on minor illness and physical defects. These data could form the background of rationalized preventive medicine in industry.

THE HEALTH OF THE SWEDISH SEAMAN. *H. Davide. Abstr. as follows from World's Health, 1927, vol. 8, pp. 118–121, in Bull. Hyg., July, 1927, vol. 2, p. 541.*

A table is given of the causes of death among Swedish seamen between 1911 and 1920. It is inexact—for instance, some leave the sea and have died from disease contracted at sea; also deaths due to disease are statistically lowered by the great number of deaths from accident, especially drowning. Deaths from tuberculosis are 10 per cent. higher among sailors than other classes; from pneumonia and cancer relatively rare. For 1920, deaths from tubercle among seamen were 15.55 per cent. of the total mortality.

Medical points of interest, some already under regulations:

(1) Medical examination is obligatory for every sailor on engagement.

(2) Medical treatment is the responsibility of the captain; also nursing. Since 1918, sailors serving abroad have a right to free treatment for venereal disease, at the expense of the State, not of the shipowner.

(3) Hours of work must not be more than 24 in two consecutive days or 18 for mates and 16 for engineers or stokers.

(4) Provisioning is regulated by special decree.

(5) Air space must be 3.4 cubic metres, floor surface 1.4 square metres per man in the accommodation.

(6) Every ship must carry a medicine chest.

(7) Inspectors have been appointed to control all activities on board a ship for protection from accident and illness. Agitation in relation to defective methods of disinfection, cleaning of quarters, separate quarters for stokers and deckhands, increased cabin space, naturally has gone ahead of legislation. Many ships are built or repaired with these details in view "for such modifications would certainly not only improve the health of the sailor, but also his capacity for work."

(8) Medical treatment by wireless lacks organization. An international medical code and international medicine chest must be established to ensure efficient working—priority for medical wireless messages is desirable.

The Swedish Red Cross Society recognizes that sailors have facilities for maintaining health in their own countries but that abroad these are not so great, and has welcomed the Norwegian Society's suggestion of the creation of dispensaries in all ports. This question is under consideration by a special committee under the presidency of H. R. H. Prince Charles.

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

MEDICAL INSPECTION OF FACTORIES IN 1926. *J. C. Bridge. Ann. Rep. Chief Inspect. Factories for 1926. H. M. Stationery Office, 1927, pp. 79–102. Cmd. 2903.*

This chapter is written for the first time by Dr. J. C. Bridge following up the resignation of Sir T. Legge. Two subjects more than others have received attention: first, epitheliomatous cancer, especially among mule spinners, and other forms of skin troubles; secondly, dust inhalation with particular reference to silica dust. Cases of skin cancer increased in numbers to 187 with 49 deaths as compared with 123 cases in 1924 with 24 deaths; mule spinning with exposure to mineral oil accounted for 88 cases and exposure to pitch for 45 cases. Generally speaking these industrial cases are all associated with some distillation product of coal. Among 64 cases of aniline poisoning reported during the last two years 4 have been tumors of the bladder. Attention was directed to dermatitis especially among bakers for whom a welfare order requiring the provision of washing appliances is hoped to prove a valuable preventive. Other cases of skin trouble are reported, *e.g.*, from chrome ulceration particularly in the industry of dyeing and finishing.

Dust arising in screening malt was found to be created in excessive amounts and to be causing cough which possibly was due to the mycelium and spores of a fungus which, however, has not yet been isolated with certainty. Cases of lead poisoning were fewer than in the previous

year, but the cessation of work due to the coal strike tempers the satisfaction with which these figures might have been regarded. A reduction of cases from painting vehicles may be ascribed to using leadless materials in spraying operations which are now coming so much into use for this purpose.

Information is given as to reported cases of gassing during the year; by far the largest number were due to carbon monoxide; out of 101 cases, six were fatal. No case came to light of fatality or serious illness occurring in garages due to the exhaust gases from motor cars. A high standard of first aid is now to be found in practically every factory, but cases are still reported of septicemia due to neglect to seek early treatment for minor injuries.—E. L. C.

SIXTH ANNUAL REPORT OF THE SECRETARY FOR MINES FOR THE YEAR 1926 AND ANNUAL REPORT OF H. M. CHIEF INSPECTOR OF MINES. *H. M. Stationery Office, 1927, pp. 179.*

This report contains the official account of the serious industrial dispute extending over six months which paralyzed the coal industry during 1926, and also interfered extensively with all other manufacturing trades. The account which is simple and clear does not attempt to distribute the blame. Following upon this dispute two Acts of Parliament were passed, one permitting work below ground to be one hour longer than previously allowed; the effect of this on output and health must be watched with interest; the other Act contains several sections intended to give force to recommendations made by the Royal Commission; the third part establishes a new fund raised from royalties which is to be used for the erection of pithead baths. The duty of spending the fund is handed to the Miners' Welfare Committee which already allocates the Miners' Welfare Fund. This Committee is erecting four experimental baths which are expected to embody advantageous novelties. This Committee completed its first five years of service; the success achieved has led to the Welfare Fund being extended for another five years. Some account is given of the activities financed during the year by the Fund, from which a sum of £4,569,235 has now been allocated.

Among the statistical tables is one dealing with cases of occupational diseases among miners for which compensation was paid. The figures for 1926 are, of course, owing to the trade dispute, not comparable with those of previous years. The figures for 1925, however, appear for the first time and we see that cases of miners' nystagmus have not yet commenced to decline nor indeed have cases of beat knee, beat hand, or beat elbow. Mortality from accidents among miners has always been high, but on the British coal fields it is lower than in other countries. It amounted for the period 1923 to 1925 to 1 per 1,000 persons employed, compared with 4.9 for America, 2.7 for Canada, 2.2 for Germany, and 0.9 for France. Much valuable information with regard to statistics in the mining industry is contained in this volume.—E. L. C.

REPORT OF THE COMMONWEALTH AND STATES OF AUSTRALIA THIRD CONFERENCE ON INDUSTRIAL HYGIENE.

MELBOURNE, 26TH MAY, 1927. *Melbourne, Govt. Printer, 1927, pp. 26.*

This is an account of the third of a series of "periodical conferences between the Commonwealth and State Health officials with representatives of Labour and Factory Departments . . . . for the purpose of ensuring uniformity with respect to records and further action on various other subjects of industrial hygiene interest."

The agenda submitted for discussion were as follows:

1. Report on activities of Industrial Hygiene Division of the Commonwealth Department of Health.
2. Progress in the various States in the directions contemplated by the recommendations of the previous conferences—
   Hygienic standards.
   Standards of qualification for factory inspectors.
   Collection of morbidity and mortality statistics.
   Factory medical inspectors.
   Restriction of employment of females and young persons.
   Medical examination of young persons.
   Lifting and carrying of weights.
   Control of dangerous trades.
   Notification of industrial diseases.
3. Practicability of exchange of officers between different State Departments of Labour from an educational viewpoint.
4. Industrial Medical Services—
   Progress.
   Methods for encouraging movement.
   Dental clinics.
   Correction of visual defects.
   Qualifications of medical advisers.
5. The Painting Industry—
   Protection of users of paints containing lead.
   Protection of workers using spray gun—
   (*a*) from volatile solvents;
   (*b*) from lead compounds.
6. Practicable measures to reduce present wastage resulting from industrial accidents.
7. Exclusion from mines, quarries, etc., of persons suffering from tuberculosis.
8. The Regulation of Offices. (British Offices Regulation Bill.)
9. Hygienic provisions contained in Awards of the Commonwealth Court of Conciliation and Arbitration.

—P. D.

A PLEA FOR GREATER COOPERATION BETWEEN THE SCIENCES OF MEDICINE AND ENGINEERING IN RELATION TO INDUSTRIES. *J. S. Just. Abstr. as follows from Med. Jour. Australia, July 2, 1927, vol. 2, pp. 2–4, in Bull. Hyg., Nov., 1927, vol. 2, p. 883.*

The author, who is an engineer, points out that fatigue in industry is directly or indirectly responsible for much loss of time due to sickness and accidents, and that its prevention is largely an engineering problem—just as sanitary engineers have made large cities possible. Clean air with efficient dust removal; drinking fountains with wholesome water conveniently placed; suppression of exposure to poisons used in industry; avoidance of eyestrain by better lighting; are all instances of how engineers must act. A word is said of danger from low voltage shocks; high voltage shocks cause muscular contractions which may throw the victim clear; but with low voltage shocks the victims are unable to "let go" and the exposure to the current is prolonged. No concern founded on human activity can be economically and psychologically healthy unless the workers are healthy. To attain this end the sciences of engineering and medicine must combine.

INDUSTRIAL HYGIENE IN BELGIUM. *E. Kalmus. Abstr. from Zentralbl. f. Gewerbehyg., April, 1927, N. S. vol. 4, pp. 114–117, in Bull. Hyg., Nov., 1927, vol. 2, p. 884.*

In Belgium medical inspection of factories and mines is a department of state *per se*, subject to no lay control (other than the Minister of Labor), and independent of the Factory Department. Then, although the population is no larger than that of London, Belgium has always had more than twice as many medical inspectors of factories as Great Britain. Latterly also, the medical inspection of young persons under 18 years of age has received special attention with a view to "orientation" in regard to the nature of the work assigned to them according to physical ability and aptitude. For this last named work both the medical inspectors and "appointed surgeons" take part, the occupier having the right to choose whether the periodic examination shall be made by the one or the other.

All the duties assigned to the medical inspectorate are set out.

SANITARY REGULATIONS WITH RESPECT TO INDUSTRY. *Italy Letter, Jour. Am. Med. Assn., Sept. 3, 1927, vol. 89, p. 805.*

The recent general legislation on industrial hygiene contains sanitary regulations applicable both to private industry and to industries managed by the state or other public bodies. The workman must be informed of the dangers of his work, especially if possibilities of asphyxiation or infection exist, and must be instructed regarding means of prevention. Supplies for rendering first aid must be on hand wherever as many as twenty-five persons are employed, and there are special regulations with regard to supplies of medicine and respecting medical examinations in factories where asphyxiating or poisonous substances are handled. The rooms of all factories constructed after this date must be not less than 3 meters in height and must contain for each person at least 10 cubic meters of space and 2 square meters of floor space. The same law limits the weight that may be carried by the arms or on the shoulder: for boys under 15 years old, to 15 kg.; for boys between 15 and 17, to 25 kg.; for girls under 15 years old, to 5 kg.; for girls between 15 and 17, to 15 kg. The weights that may be transported in two-wheeled carts are defined as follows: on a flat surface, eight times the weights given above; on iron rails, twenty times the weights given above; in each case the weight of the vehicle is to be included.—K. R. D.

DATA FOR AN INVESTIGATION INTO THE HEALTH CONDITIONS OF GLASS BLOWERS IN A BOTTLE FACTORY AT CONSTANTINOV. *M. Ekelov. Abstr. from Prophylactic Med., Kharkov, Dec. 12, 1926, p. 32, in Bull. Hyg., Nov., 1927, vol. 2, pp. 879–880.*

After a description of the factory and the work, Ekelov gives tables showing the ages of the workers, conditions found, etc. From these tables the conclusions arrived at are:

(1) Glass blowing calls for great physical energy and adaptability to special conditions on the part of the human organism. It may cause pathological changes in many different organs, but more particularly in the lungs and heart. Therefore, it must be considered a highly dangerous trade.

(2) The basis of the pathological changes in heart and lungs is premature exhaustion of tissues. Hence the emphysema and cardiac insufficiency found among glass blowers. Congenital or early acquired specific biological weakness conduces to the development of these conditions, and there-

fore, the work can only be done by men sound in heart and lungs.

(3) All entrants to the work should be medically examined and only those in sound health accepted. During the first two or three years all apprentices should be re-examined and any who show early pathological changes in heart or lungs rejected.

(4) Engineers and hygienists have from time to time suggested various measures, but with only doubtful benefit. The author considers that there can be no radical improvement except by the complete mechanization of the work and the elimination of manual glass blowing, which has already been started in this factory.

PROTECTION OF THE HEALTH OF SAILORS. *Bourguin, A. Cavaillon, and M. Clerc. Rev. d'hyg., 1927, vol. 49, pp. 241–252.*

This is a detailed study of measures possible and in use in France against social evils, tuberculosis, and venereal disease in the mercantile marine.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

TAR CANCER. *Italy Letter, Jour. Am. Med. Assn., Sept. 17, 1927, vol. 89, p. 981.*

A case of tar cancer was recently described by Dr. Balduzzi of the Clinica Dermosifilopatica in Padua, as occurring in an old man who, for many years, was engaged in building boats and covering them with pitch. The skin changes, consisting of lesions of various types (pigmentations, folliculitis, varicosities, and the like), were found on various parts of the face and limbs. When subjected first to radium therapy and then to surgical intervention, the tumor retrogressed. This is one of the few cases of tar cancer ever described in Italy. In England, 133 cases were reported during the period 1920 to 1923.—K. R. D.

OCCUPATIONAL LESIONS IN WORKERS IN SUGAR. *Belgium Letter, Jour. Am. Med. Assn., Sept. 10, 1927, vol. 89, p. 896.*

Dr. Watry has reported that workers in sugar are all affected, after six years, with dental lesions, frankly of occupational origin. Packers of cookies and cakes are affected to a somewhat slighter extent (85 per cent.) owing to the smaller quantity of sugar dust. The matter of predisposition is of essential importance in the workmen. The best prophylaxis would be effective examination of apprentices. Sugar dust causes a gingivitis of purely mechanical origin. After the gingivitis stage, a deposit of a sugary substance, a veritable sugar syrup, constituting the membrane of caries, is formed. Caries, protected by this sugar sheath, develops in a semilunar form or resembling a three-quarters moon (a form more or less raised above the gums). He found also digestive disorders (gastralgia, loss of appetite, constipation), respiratory conditions (pharyngitis, particularly in women), and cutaneous conditions, especially of the face.—K. R. D.

ACUTE CIRCUMSCRIBED EDEMA (QUINCKE). *H. H. Drysdale. Jour. Am. Med. Assn., Oct. 22, 1927, vol. 89, pp. 1390–1393.*

Drysdale reports a case of acute circumscribed edema of the hand occurring in a workman following a

blow on the dorsum of the first and second fingers, but due, in the author's opinion, not to trauma but to the mental instability of the patient.—K.R.D.

CENTRAL NERVOUS SYSTEM

RELATION OF OCCUPATION TO MIGRAINE. *W. Allan. Abstr. as follows from Jour. Nerv. and Ment. Dis., Aug., 1927, vol. 66, p. 131, in Jour. Am. Med. Assn., Oct. 29, 1927, vol. 89, p. 1551.*

The occupations of 400 migrainous patients have been tabulated by Allan as compared with the occupations of 1,000 nonmigrainous patients. Among the women, the housewives outnumbered all others; among the men, the business men were in the majority. Housewives: normal women, 360; migrainous patients, 191. Business men: normals, 233; migrainous, fifty-nine. The business women came next with thirty-seven migraines, and the professional men with thirty.—K. R. D.

CIRCULATORY SYSTEM

POLYCYTHEMIA IN FEATHER DYERS. *E. S. Kilgore. Jour. Am. Med. Assn., July 30, 1927, vol. 89, pp. 342–344.*

Kilgore reports the case of a German feather dyer, aged 61, who showed clinically a high red count (up to 9,100,000), considerable cyanosis of the nose, lips, and ears, palpable spleen, some fibrosis of the apex of the right lung, and, terminally, severe substernal and precordial pain. At autopsy there was found erythroblastic hyperplasia of the marrow of the long bones, coronary thrombosis, chronic myocarditis, splenic and renal embolism, and fibrous tuberculosis of the right apex. Two years previously the cyanosis and other physical features were present but the blood examination was not remarkable. Before the patient's death there came to visit him his assistant in feather dying; a woman, aged 39. Her red cells at one time numbered 12,400,000. She improved following irradiation and benzene treatments.—K. R. D.

NEUROMUSCULAR SYSTEM

MOTOR ARM. *H. S. Gaskell. Abstr. as follows from Practitioner, London, Sept., 1927, vol. 119, p. 190, in Jour. Am. Med. Assn., Nov. 19, 1927, vol. 89, pp. 1817–1818.*

This condition, according to Gaskell, is caused by the current of air which is deflected by the windshield back into the car and makes a semicircle, the rear end of whose arc impinges directly on the back of the driver's torso. This point corresponds with the emergence of the fourth, fifth, sixth, seventh, and eighth cervical nerves; hence trouble on one side or the other often ensues. Both anterior and posterior divisions of these nerves are affected, the anterior, forming the brachial plexus, giving rise to the arm symptoms, and the posterior, piercing and spreading among the fibers and aponeuroses of the splenius and trapezius muscles, being responsible for the initiatory "stiff neck" and shoulder pains. The patient wakes in the morning with what he takes to be an ordinary "stiff neck," but in about eight hours is disagreeably undeceived as to the nature of his complaint. The shoulder aches badly, and the arm then takes on a heavy, continuous pain which extends to the hand and

is variously described as "an aching right in the bone," "the gnawing of a tiger," and "rats biting the bone." If it is a true neuritis, sooner or later the patient will complain of tingling and numbness, these being more common in the hand and forearm, the former involving the whole hand and the latter being usually confined to the area supplied by the terminal branches of the median nerve in the thumb, first, and second fingers. If it is a perineuritis, these will be absent, but the pain will be no less severe. This "pins and needles" sensation is often an end-symptom, the disease dying hard and making its presence felt to the last by this means in various parts of the limb. Actual movement and use of the arm, unlike the case of strains and muscular affections, though detrimental to recovery, does not seem to cause much exacerbation of the pain at time of movement, though it may do so very shortly afterward. Writing may be painful or impossible. For the severer cases, rest in bed is essential. Heat should be applied to the arm. All active stimulation, such as vigorous rubbing and movement, should be avoided.—K. R. D.

AN OCCUPATIONAL SWELLING. *W. H. Ogilvie. Brit. Med. Jour., Feb. 5, 1927, vol. 1, p. 232.*

This is a report of a case of swelling below the angle of the jaw on the left side in a professional violinist. The swelling had been noticed for three or four years and had slowly increased in size but caused no pain or discomfort. The appearance suggested an enlargement of the tonsillar lymph gland. However, the enlargement was entirely due to a thickening in the subcutaneous tissues, adherent to the overlying skin, but freely movable over the deeper structures. It was firm, had no definite edge, did not fluctuate, and was not translucent. The overlying skin was normal, and there was no enlargement of the lymphatic or salivary glands on either side. The tonsils were small and healthy.

This is apparently a fibrofatty pad developed in response to repeated pressure, analogous to that which is seen on the shoulders of deal porters. It is situated exactly on the area of skin which rests upon the edge of the violin when this is steadied between the angle of the jaw and the left clavicle.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

FACTS REGARDING RISKS IN THE SUPERPHOSPHATE INDUSTRY. *K. B. Belenkaya. Abstr. as follows from Prophylactic Med., Kharkov, Dec. 12, 1926, p. 54, in Bull. Hyg., Nov., 1927, vol. 2, p. 880.*

Mainly an account of the process and organization of the manufacture of superphosphates by heating mineral calcium phosphate with sulphuric acid. The occupation is extremely dusty and the workers are exposed to sulphur dioxide and nitrous fumes; the latter being the most troublesome, particularly in a dry atmosphere. The men complain of choking, cough, lacrimation, nasal catarrh, and tingling of the skin on the arms and face.

After three or four hours in the proximity of the Gay Lussac and Glover towers, the men sometimes suffer from an acute laryngitis which lasts for three or four days.

DISEASES CAUSED BY DYES AND CLEANING FLUIDS. *H. Schmidt-Lamberg. Abstr. as follows from Zentralbl. f. inn. Med., May 7, 1927, vol. 48, p. 474, in Jour. Am. Med. Assn., July 30, 1927, vol. 89, pp. 419–420.*

Schmidt-Lamberg publishes statistics on the occupational diseases of cleaners and dyers. The gases from cleaning fluids caused a considerable number of diseases of the lungs, bronchi, and larynx. Abscesses and septic conditions occurred in many cases and caused eighteen deaths in Prussia. It is probable that the gravity of the process would have been less if the workers had taken care of small injuries, instead of exposing them repeatedly to the cleaning fluids and dyes.—K. R. D.

LEAD STUDIES. XV. THE EFFECT OF THE PARATHYROID HORMONE ON THE EXCRETION OF LEAD AND OF CALCIUM IN PATIENTS SUFFERING FROM LEAD POISONING. *D. Hunter and J. C. Aub. Quart. Jour. Med., Jan., 1927, vol. 20, pp. 123–140.*

This investigation emphasizes significantly the parallelism between calcium and lead metabolism. The previous work of Aub and his collaborators has shown that ammonium chloride and phosphoric acid both increase the rate of elimination of stored lead. In this investigation Hunter shows very clearly that parathyroid extract causes considerable excretion of calcium and of lead from the bones of patients afflicted with lead poisoning. An increase in calcium excretion followed the administration of parathyroid extract irrespective of whether the blood calcium was raised and was much more marked in the urine than in the feces. It is of interest that the lead excretion was definitely increased when parathyroid extract was first given and exceeded the amounts excreted under ammonium chloride or phosphoric acid treatment. When given a second time the extract produced little or no rise in lead excretion. The remaining lead is mobilized more slowly. "The rapid elimination of large amounts of lead produced no ill effect. However, owing to the risk of hypercalcaemia and possibly of renal damage, parathyroid extract should be used only in selected cases and always with adequate laboratory control."

The foregoing work represents a distinct and very interesting advance in the therapy of lead poisoning. —L. T. F.

BLOOD CHANGES IN EXPERIMENTAL ACUTE LEAD POISONING. *K. Fujita. Abstr. as follows from Acta Dermat., Kyoto, Jan., 1927, vol. 9, p. 58, in Jour. Am. Med. Assn., June 11, 1927, vol. 88, p. 1934.*

By feeding rabbits lead acetate, Fujita produced an experimental acute lead poisoning. The erythrocytes were lessened in number; the leukocytes were increased. The quantity of fibrinogen in the blood plasma and in the hemoglobin was diminished. The erythrocyte resistance against hypotonic salt solution was changed but little.—K. R. D.

TOXICITY OF TETRA-ETHYL LEAD AND INORGANIC LEAD SALTS. *R. A. Kehoe. Abstr. as follows from Jour. Lab. and Clin. Med., March, 1927, vol. 12, p. 554, in Jour. Am. Med. Assn., June 11, 1927, vol. 88, p. 1931.*

The toxicity of tetraethyl lead has been determined by Kehoe for rabbits by the various methods of administration. Comparison of the toxicity of tetraethyl lead with an inorganic lead salt indicates that its toxicity is a function of its lead content. An explanation of the delayed effect of tetraethyl lead, as compared with salts of lead, is offered. It is suggested that tetraethyl lead owes its toxicity to a decomposition reaction which produces water soluble compounds of lead that are capable of coagulating proteins.—K. R. D.

CASE OF ANTRAL SINUSITIS COMPLICATED BY RADIUM POISONING. *F. B. Flinn. Laryngoscope, May, 1927, vol. 37, p. 341.*

IDIOSYNCRASY TO ZINC. *Pappenheimer. Med. Klin., June 10, 1927, vol. 23, p. 871.*

AN INVESTIGATION OF THE EFFECT OF LONG-CONTINUED INGESTION OF ZINC, IN THE FORM OF ZINC OXIDE, BY CATS AND DOGS, TOGETHER WITH OBSERVATIONS UPON THE EXCRETION AND THE STORAGE OF ZINC. *K. R. Drinker, P. K. Thompson, and M. Marsh. Abstr. as follows from Am. Jour. Physiol., March, 1927, vol. 80, pp. 31–64, in Jour. Am. Med. Assn., June 11, 1927, vol. 88, p. 1927.*

Drinker *et al.* have never observed any significant clinical symptom nor obtained any significant laboratory evidence of harm resulting from the daily ingestion of zinc oxide over long periods of time. With the exception of fibrous change in the pancreases of three cats subjected to doses of zinc greatly in excess of any possible human exposure, histologic examination following autopsy has not shown any injury in the organs of experimental cats and dogs attributable to zinc. Studies on zinc excretion in zinc fed animals indicate that a small fraction of absorbed zinc leaves the body in the urine, but that the main bulk of it is excreted into the alimentary tract—some of it directly, some of it by the liver into the bile, and possibly some of it by the pancreas—and ultimately leaves the body in the feces. The amount of zinc in the urine of zinc fed animals is markedly increased over the normal, though the total amount of zinc in the urine is only a small fraction of the total excreted. It is worthy of note that animals excreted abnormal amounts of zinc through the kidneys for months without any histologic evidence of kidney injury. A possible connection is suggested between the zinc content and the functional activity of the suprarenals and of the sex glands.

THE EFFECT OF ZINC ADMINISTRATION UPON REPRODUCTION AND GROWTH IN THE ALBINO RAT, TOGETHER WITH A DEMONSTRATION OF THE CONSTANT CONCENTRATION OF ZINC IN A GIVEN SPECIES, REGARDLESS OF AGE. *P. K. Thompson, M. Marsh, and K. R. Drinker. Abstr. as follows from Am. Jour. Physiol., March, 1927, vol. 80, pp. 65–74, in Jour. Am. Med. Assn., June 11, 1927, vol. 88, p. 1927.*

Thompson *et al.* found that the daily feeding of organic zinc salt solutions (acetate, citrate, and malate) or of zinc oxide suspensions in doses of from 2 to 38 mg. of zinc to albino rats, not only for many weeks previous to mating, but during pregnancy and lactation as well, did not have any significant effect on the health of the parents, on fertility, or on the health and early growth of the offspring. The offspring of zinc fed parents, weaned at 23 days of age and themselves put on daily doses of zinc, grow at a normal rate and to a normal adult size.

THE NORMAL EXCRETION OF ZINC IN THE URINE AND FECES OF MAN. *K. R. Drinker, J. W. Fehnel, and M. Marsh. Jour. Biol. Chem., March, 1927, vol. 72, pp. 375–383.*

Drinker *et al.* present figures on the normal amounts of zinc present in the urine and feces of a large group of healthy adults on an ordinary mixed diet, the range and average of figures upon the total zinc content of twenty-four-hour specimens being as follows: urine, range 0.25 to 2 mg., average 0.89 mg.; feces, range 2.67 to 19.9 mg., average 9.8 mg.

In addition to providing data for the establishment of normal standards of zinc excretion in man, the observations reported prove that amazing increases in fecal zinc excretion may occur following the ingestion of high zinc foods—increases which may last for several days. The work indicates also that significant increases in the normal content of zinc in urine do not result from the ingestion on single occasions of high zinc foods but offers no evidence as to whether or not the normal urinary zinc level would be raised if foods unusually rich in zinc were continually ingested.

DUST HAZARDS AND THEIR EFFECTS

PNEUMONOCONIOSIS CAUSED BY ASBESTOS DUST. *London Letter, Jour. Am. Med. Assn., July 23, 1927, vol. 89, p. 304.*

At a conference of the Royal Microscopical Society, held at Liverpool, a case of pneumonokoniosis due to asbestos dust was reported by Dr. W. E. Cooke and Mr. C. F. Hill. It appears to be only the second reported in this country. The particles found in the lungs were large, some measuring as much as 360 microns. They represented the brittle iron containing part of the asbestos fibers. The dust contained 18 per cent. of iron as ferrous oxide, the raw material 2.1 per cent., and the finished article 0.1 per cent. The microscopic appearances of the dust were identical with those of the particles found in the lungs.—K. R. D.

THE EFFECT OF CEMENT DUST UPON THE LUNGS AND THE QUESTION OF TUBERCULOSIS AMONG CEMENT WORKERS. *Fraenkel, Hack, and F. Schott. Abstr. as follows from Zement, 1926, vol. 15, pp. 126–128, 146–148, in Chem. Abstr., Oct. 10, 1927, vol. 21, p. 3260.*

Decades spent in the dust laden atmosphere of a cement plant did not lead to any dangerous disease of the lungs in 100 cases observed. The

most severe conditions stimulated were catarrh and dust impregnated lungs which did not lessen the worker's powers or shorten his life or working period.—P. D.

THE RADIOGRAPHIC PICTURE IN CHALICOSIS, AND ITS DIFFERENTIAL DIAGNOSIS FROM OTHER AFFECTIONS OF THE LUNGS. *P. F. Møller. Acta radiol., July, 1927, vol. 8, pp. 193-208.*

The summary following this paper is as follows:

The author describes the radiological changes in chalicotic lungs—"porcelain workers' lungs"—and points out that the changes, from the moment the condition has reached a certain stage of development, are of a kind and character which will always make it possible to make the correct diagnosis, provided one possesses a flawless radiogram of the case. At the same time, he shows—by juxtaposing radiograms of chalicotic lungs to pictures representing certain forms of tuberculosis and other pathological lung conditions, notably lymphogenous carcinomatosis and syphilis of the lungs—that the differential diagnosis from those other conditions *can* be difficult; he points out what changes are characteristic of one or another of those conditions; and he lays stress on the important rôle of the clinical findings and the anamnesis as aids to a correct interpretation of such cases.

The text is followed by a series of twenty excellent radiograms showing second and third stage chalicosis; pulmonary and miliary tuberculosis; granite cutters', chalicotic, and anthracotic lungs complicated with tuberculosis; and other conditions which might be confused with second or third stage pneumonokoniosis.—P. D.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

CHANGES IN WHITE BLOOD CORPUSCLES DURING WORK. *A. F. Goldberg and M. V. Lepskaia. Abstr. as follows from Jour. de physiol. et path. gén., Dec., 1926, vol. 24, p. 715, in Jour. Am. Med. Assn., June 25, 1927, vol. 88, p. 2054.*

Goldberg and Lepskaia examined the blood of 300 healthy persons during physical and mental work. In both the number of leukocytes increased, especially that of the neutrophils, which reached 82 per cent. The lymphocytes and eosinophils were reduced; the eosinophils disappeared entirely when the work was prolonged. The number of basophils and of monocytes increased; neutrophil myelocytes, plasmocytes, and Türck's cells appeared. The changes in the leukocyte picture are ascribed to irritation of the hematopoietic organs by products of an accelerated nitrogen metabolism in muscular exercise, and by products of an accelerated phosphorus metabolism in mental exercise. The phenomena were more pronounced in intellectual work than in physical work. There was return to normal in about two hours.—K. R. D.

PHYSIOLOGY OF WORK. *E. Atzler and R. Herbst. Abstr. as follows from Arch. f. d. ges. Physiol., Jan. 7, 1927, vol. 215, p. 291, in Jour. Am. Med. Assn., May 14, 1927, vol. 88, p. 1609.*

Using the Zuntz-Geppert respiration apparatus, Atzler and Herbst studied on one experimental subject the economy of walking and of pulling

and pushing loads on a horizontal surface. The most favorable rate of speed in walking was 87.5 steps per minute; the optimum length of a step, 58.7 cm., and the optimum velocity, 51.4 meters per minute. The optimum load in both pushing and pulling was 14.5 kg. —K. R. D.

PHYSIOLOGY OF WORK. *G. Lehmann. Arch. f. d. ges. Physiol., Jan. 7, 1927, vol. 215, p. 329.*

PHYSIOLOGY OF MONOTONY. *R. J. S. McDowall and H. M. Wells. Abstr. as follows from Brit. Med. Jour., March 5, 1927, vol. 1, p. 414, in Jour. Am. Med. Assn., May 28, 1927, vol. 88, p. 1767.*

McDowall and Wells regard monotony as being an increasingly important industrial problem. It is emphasized that a vascular reaction may be brought about by any form of stimulation or effort, actual or anticipated, provided the stimulus is not too often repeated. As soon as the stimulation or effort becomes monotonous, the vascular reactions are no longer obtained. —K. R. D.

EFFECT OF EARLY MORNING EXERCISES (SPORTS) ON THE DAY'S WORK. *T. Wohlfeil. Abstr. as follows from Arch. f. Hyg., 1927, vol. 98, pp. 84–94, in Bull. Hyg., Nov., 1927, vol. 2, p. 886.*

The author sets out the results of an investigation into the effect of early morning sport (rowing, running) on the capacity for work and general well-being during the subsequent day's work. The importance of the inquiry from the school and university point of view is insisted on. Tests were made on three successive days: (1) control day; (2) sport day; (3) control day. The persons subjected to the tests were four members of the Institute of Hygiene (two men and two women). The procedure was on the "sport day" to get up between 6 and 8 o'clock, carry out the exercises, and then five times during the day to undergo fatigue tests (at 8:30, 11, 1, 3, and 6).

The general conclusion arrived at was that physical exercises of short duration had no appreciable injurious effect on subsequent work during the day. The effect had relation to the degree of practice in the particular exercises, on their length and the frequency of their repetition. A single biggish effort in the early morning, such as sprinting a 100 meters, will leave no lasting fatigue except in quite untrained persons. Lengthy efforts, on the other hand, are extraordinarily fatiguing. To practise running 1,500 or 5,000 meters in the morning for training purposes is thoroughly unsound. Such exercises affect work detrimentally and might be expected to lead to nervous symptoms.

MEASURING PHYSICAL FATIGUE. *W. Strauss. Abstr. as follows from Klin. Wchnschr., March 12, 1927, vol. 6, p. 483, in Jour. Am. Med. Assn., June 18, 1927, vol. 88, p. 2007.*

Strauss measured the electric current derived from the upper extremity and from the mucous membrane of the lower lip. He found that fatigue lowers the difference of potential between these two regions (by increasing the potential of the skin). The time required for restitution seems to be fairly constant in the same individual. He hopes to develop this method to an

objective measurement of fatigue.—K. R. D.

SEATS AND TABLES FOR USE IN INDUSTRY. *Ascher. Abstr. as follows from Zentralbl. f. Gewerbehyg., April, 1927, N. S. vol. 4, pp. 97–100, in Bull. Hyg., Nov., 1927, vol. 2, p. 887.*

Attention is being more and more directed to the importance of providing suitable seats for workpeople according to the nature of their work. The present article is no complete survey of the question, but rather enunciation, with a few illustrations, of the principles underlying the problem. The illustrations are taken from a catalogue issued by the Toledo Metal Furniture Co., which the author regards as very practical. He lays most stress on the necessity for some support to the lumbar vertebrae, support for the arms, and a *point d'appui* for the toes.

A LUMBAR SUPPORT FOR USE ON A DESK CHAIR. *T. Wohrizek. München. med. Wchnschr., June 10, 1927, vol. 74, pp. 979–981.*

A description with illustrations is given of a desk chair with a lumbar support adapted for use in sitting occupations.

AN EXPERIMENTAL STUDY OF DIATHERMY. I. THE MEASUREMENT OF LUNG TEMPERATURE. *C. A. L. Binger and R. V. Christie. Jour. Exper. Med., Oct., 1927, vol. 46, pp. 571–584.*

Summary and conclusions are given as follows:

1. Experimental evidence is furnished to show that in normal animals the rectal temperature can be elevated by the passage of high frequency currents.

2. During life the intraabdominal and intrathoracic temperatures can be increased only slightly above the rectal temperature.

3. The lung temperature in the anesthetized dog normally lies 0.3–0.4°C. below the rectal temperature. During the passage of diathermy currents of strengths equivalent to those used in therapy this relationship is reversed—the lung temperature exceeding the rectal temperature by about the same value.

4. Immediately after death, the temperature rises abruptly in the deep tissues between the electrodes.

5. For the measurement of deep temperature special thermocouples have been devised. Their method of preparation and mode of use are described.

AN EXPERIMENTAL STUDY OF DIATHERMY. II. THE CONDITIONS NECESSARY FOR THE PRODUCTION OF LOCAL HEAT IN THE LUNGS. *C. A. L. Binger and R. V. Christie. Jour. Exper. Med., Oct., 1927, vol. 46, pp. 585–594.*

Summary and conclusions are given as follows:

1. Prevention of the access of air to one lung, while its circulation is intact, results in little, if any, change in the rate of heating of the lung by the diathermy current.

2. Occlusion of a main branch of the pulmonary artery during the flow of the current results in a sudden rise in temperature in the lung whose artery has been occluded, with subsequent heating, however, at the original rate. Under these circumstances death of the animal is accompanied by a precipitous rise in the temperature of both lungs.

3. When the pulmonary veins as well as the artery to one lung are ligated the circulation through the bronchial vessels is also stopped. Diathermy then results in a local rise in temperature in the lung equivalent to that seen in the other lung after death.

AN EXPERIMENTAL STUDY OF DIATHERMY. III. THE TEMPERATURE OF THE CIRCULATING BLOOD. *C. A. L. Binger and R. V. Christie. Jour. Ex-*

per. Med., Oct., 1927, vol. 46, pp. 595–600.

Summary and conclusions are given as follows:

1. A method of measuring intravascular temperatures in anesthetized dogs has been described.

2. The temperature in the abdominal aorta is uniform throughout, and varies only with the systemic temperature.

3. The temperature in the inferior vena cava rises as the thermocouple approaches the heart, reaching its maximum at about the level of the hepatic veins. Between the hepatic veins and the right chambers of the heart there is no further elevation in venous temperature.

4. The temperature of the right heart blood normally exceeds that of the left heart blood by 0.05–0.2°C.

5. During the application of high frequency currents to the thorax, this relationship is reversed.

6. This indicates that the lungs are being heated but that the blood passing through the pulmonary vessels is removing the heat at approximately the rate of production.

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

THE BLOOD UNDER LOW ATMOSPHERIC PRESSURE. *C. Seyfarth. Abstr. as follows from Klin. Wchnschr., March 12, 1927, vol. 6, p. 487, in Jour. Am. Med. Assn., June 18, 1927, vol. 88, p. 2007.*

Seyfarth observed an increased percentage of erythrocytes with supravital granulations in animals kept at low air pressure. The rapidity of the increase depends on the general condition of the animal. The granular erythrocytes have a larger diameter than the mature cells.—K. R. D.

VARIATION IN BODY TEMPERATURE OCCURRING WITH LOW ATMOSPHERIC PRESSURE. *P. Béhague et al. Abstr. as follows from Compt. rend. Soc. de Biol., March 25, 1927, vol. 96, p. 766, in Jour. Am. Med. Assn., Sept. 3, 1927, vol. 89, p. 828.*

Rabbits were placed in a box from which air was withdrawn. Reduction in the air pressure was paralleled by fall of temperature in the animals. Hypothermia occurring in low atmospheric pressure, such as at a high altitude, resembles that in prolonged asphyxia. It is due to reduced oxidation resulting from oxygen deficiency.—K. R. D.

CHANGES IN LIVER FROM LOW AIR PRESSURE. *A. Loewy. Biochem. Ztschr., June 9, 1927, vol. 185, p. 287.*

INJURY TO THE SKULL FROM ELECTRIC CURRENT. *E. Ranzi et al. Abstr. as follows from Deutsch. Ztschr. f. Chir., March, 1927, vol. 200, p. 36, in Jour. Am. Med. Assn., July 16, 1927, vol. 89, p. 255.*

The case described by Ranzi, Mayr, and Oberhammer is that of a man injured by an electric current while at work in an electric locomotive. The current entered the body above the right ear and passed out at the vertex, a little to the left. He was removed unconscious, but had recovered consciousness at the end of seven hours. The wounds were treated conservatively. In each the skin necrosis progressed and the bone became exposed. A month after the injury, epileptic

attacks set in, with paresis of the right side of the face and the right upper extremity. Four operations were performed, at which epidural, subdural and brain abscesses were opened and the diseased bone cleaned away. Streptococci and pneumococci were found in the pus from the abscesses in the brain. The patient died two months after the injury. On microscopic examination the bone showed rarefying, sequestrating osteomyelitis, the necrosis limited by granulating inflammation. The authors suppose that the electric current killed bone cells, which thus became a fit field for infection by extension from the suppurating soft parts. They advise active treatment, with early trephination, in cases in which the bone necrosis progresses rapidly and intracranial complications are to be feared. —K. R. D.

ACCIDENTS FROM ELECTRICITY. *S. Tousey. Physical Therap., June, 1927, vol. 45, p. 293.*

HEAT, COLD, AND HUMIDITY

THE EFFECT OF MODERATELY HIGH TEMPERATURE AND HUMIDITY ON THE CENTRAL NERVOUS SYSTEM. *A. M. Baetjer. Am. Jour. Hyg., July, 1927, vol. 7, pp. 481–504.*

This work contributes very materially to a controversial subject on which there are few data. Strictly speaking, the author's findings seem to be in accord with those of the New York State Commission on Ventilation, which found that moderately high temperatures and humidities had no effect on mental work, rather than with those of Huntington, Sutton, and Lehman and Pedersen, who reported a decided effect.

Baetjer's results were negative in knee jerk experiments, co-ordination tests, visual and auditory acuity, and mental process of adding, so long as muscular fatigue was avoided. When the test was repeated over and over, however, with no rest pauses, the subject's steadiness diminished and he became fatigued sooner than he would under more normal atmospheric conditions. In other words, in the absence of fatigue as a factor, Baetjer is entirely in agreement with the findings of the New York State Commission on Ventilation, but when the element of fatigue is introduced, her results correspond with those of the other observers mentioned.

A tentative, but very important conclusion derived from this work is that the reactivity of the nerve centers is not appreciably affected by exposure to moderately high temperatures (90 to 100°F.) and humidities (60 to 90 per cent.), and that it is probably the muscles which are affected.—C. P. Y.

WOMEN AND CHILDREN IN INDUSTRY

INDUSTRIAL PATHOLOGY OF PREGNANCY AND LABOR. *M. Hirsch. Abstr. as follows from Zentralbl. f. Gynäk., Jan. 15, 1927, vol. 51, p. 136, in Jour. Am. Med. Assn., June 18, 1927, vol. 88, p. 2009.*

This study, made by Hirsch, comprises 3,165 completed pregnancies of women employed in the textile industry. The course of labor was pathologic in 34.4 per cent. Pathologic labors were 18 per cent. more frequent in women who worked standing than in those who sat at their work. Premature births, stillbirths, forceps deliveries, and cesarean sections were about 50 per cent. more frequent in these women than in the general population; they were much more frequent in the women who stood than in those who sat at their work. Varicose veins occurred nearly three times as often in the women who stood as in those who sat.—K. R. D.

INFLUENCE OF VARIOUS OCCUPATIONS ON WOMAN'S ORGANISM. *M. P. Bushmakina. Irkutskiy Med. Jur., Jan.–April, 1927, vol. 5, p. 33.*

LEGAL PROTECTION OF WOMAN WORKER. *R. F. Lyne. Jour. State Med., May, 1927, vol. 35, p. 287.*

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

HYGIENE AND ROENTGEN-RAY EXAMINATIONS IN BRONZE FACTORIES. *E. Krüger and E. Saupe. Klin. Wchnschr., Jan. 8, 1927, vol. 6, p. 77.*

MEDICAL AND SURGICAL SERVICE IN INDUSTRIAL WORLD. *S. D. Swope. Southwest. Med., March, 1927, vol. 11, p. 111.*

RELATION OF AN INDUSTRIAL MEDICAL DEPARTMENT TO A COMMUNITY HEALTH PROGRAM. *W. A. Sawyer. Jour. Am. Med. Assn., Oct. 22, 1927, vol. 89, pp. 1408–1411.*

This is a discussion of the contributions which industrial medical departments can make to community health work.—K. R. D.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

AN INVESTIGATION IN A PRINTING WORKS. *A. R. Knight and M. F. Peterson. Abstr. as follows from Jour. Nat. Inst. Indust. Psychol., July, 1927, vol. 3, pp. 359–363, in Bull. Hyg., Nov., 1927, vol. 2, p. 878.*

A résumé is given of seven months' investigation at a printing works. At one process 80 per cent. of necessary walking was eliminated and undue strain in lifting heavy "forms." In another instance unproductive walking amounting to nearly 2 miles was abolished and the time spent was reduced by 10 to 20 per cent. Ventilation and lighting were improved at particular processes. The introduction of a fifteen-minute rest pause (mid-morning) for refreshment decreased strain, lessened fatigue, and improved organization. Periodic discussions between management and workpeople were instituted and created a contented atmosphere.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

WELFARE WORK OUTSIDE WORKING HOURS. *A. Parent and M. Herman. Abstr. as follows from Rev. d'hyg., March, 1927, vol. 49, pp. 177–195, in Bull. Hyg., Aug., 1927, vol. 2, pp. 634–635.*

A report is here presented upon what has been done in the province of Hainaut to provide the worker with healthy recreation during his hours of leisure. The subject first came to be considered when the eight-hour day became law. A committee went into the whole question and now groups its activities under seven separate headings. First comes housing; here not only is the warmth, comfort, and the decoration of the house studied, but the type of furniture suitable for artisan dwellings has been considered. Efforts are made to interest the workers in their houses from the point of view of health, use, and artistic appearance. Secondly, cottage and allotment gardens have received consideration. The raising of flowers, trees, and vegetables has been encouraged. Horticultural exhibits and garden competitions have been set on foot. Healthy and beneficent emulation has been created with satisfactory results, since gardening is the ideal occupation, in their spare time, for factory workers. A third line of activity has been to set on foot the raising of small live stock, such as birds, rabbits, and bees. Methods of procedure have been popularized, and means for bringing eggs and other products to the market arranged. The success of this line of action has surpassed expectation. And societies, each holding its own meetings, have sprung up dealing with each special line of live stock. Physical education has been instigated by means of gymnastic societies and sports clubs. These activities have met with considerable success and are being supported liberally from the funds placed at the disposal of the committee. The committee has also organized artistic education in reference to music, drama, and drawing. A large number of musical societies have been brought into existence with a membership of about 11,500 persons. This line for artistic expression has been organized in close association with that of housing. Another line of education has had reference to reading clubs and popular lectures. Here also considerable success has been achieved. Some effort has been made to introduce the cinema as a means of education. The importance and value of the work which is being done in the province is considerable. It is already contributing to an active and healthy life. But its activities are only just thoroughly started, and the results which are to be expected in the future are considerable.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

WHITE LEAD. DATA COLLECTED BY THE INTERNATIONAL LABOUR OFFICE IN REGARD TO THE USE OF WHITE LEAD IN THE PAINTING INDUSTRY.

Internat. Labour Office, Studies and Rep., Series F (Indust. Hyg.) No. 11, 1927, pp. 409.

A prolonged controversy has been waged in Western Europe as to whether the use of lead compounds in paints should be prohibited. The evidence accumulated on the subject has now been brought together in the publication under review. Those who hold that lead should be prohibited point to the amount of illness and mortality from lead poisoning experienced by painters. This injury is commonly held to be caused by the inhalation of dust generated when painted surfaces are rubbed down in order to obtain a smooth surface. Such rubbing down has been done with dry sandpaper. Moreover they maintain that other materials can be used instead. Those who oppose the prohibition of lead declare that no other material can take its place, that the damage caused by lead poisoning arising from painting operations is exaggerated, and that the dust generated in rubbing down can be got rid of by using waterproof sandpaper. A cynical onlooker notes that the chief advocates of prohibition are countries where zinc white, the chief rival of white lead, is manufactured; and that countries manufacturing white lead are less ready to abolish its use. Information is brought together in this book bearing on the whole question from many sources and many countries. It is well and clearly stated without pronounced bias; even though the volume is published from Geneva, and even though at the third session of the International Labour Conference held at Geneva in 1921 the decision was arrived at to recommend the abolition of the use of lead in paints used on the interior of buildings.

Some review is given of painting operations from their medical aspect and of the illness which results, as obtained from seventeen different countries. The legislative remedies adopted are also stated. Agreement is found that some action should be taken either by so regulating painting operations as to protect the painter from risk, or by prohibiting the use of lead compounds. Some countries have taken one course; others the other. Much of the evidence stated is drawn from research work and investigations carried out in England and also in other parts of the British Empire. Reference is also made to inquiries conducted and action taken in many other parts of the world, including the United States of America; where, however, having in view the extent of painting operations the attention so far paid to the subject does not appear to be great. As a book of reference this volume is one of the most useful yet published from Geneva.—E. L. C.

REPORT TO HIS MAJESTY'S SECRETARY OF STATE FOR THE HOME DEPARTMENT ON THE DRAFT REGULATIONS FOR PREVENTING DANGER FROM LEAD PAINT TO PERSONS EMPLOYED IN OR IN CONNECTION WITH THE PAINTING OF BUILDINGS. *W. W. Mackenzie. H. M. Stationery Office, 1927, pp. 32.*

The question as to whether the use of lead in paint is a necessity has long been controversial. That it is associated with the occurrence of poisoning among the painters is certain. Great

Britain has decided by law to permit its continued use under a code of Regulations. The report under consideration states all the circumstances preceding legislation; it is concerned with an inquiry held to determine the practicability of certain draft Regulations proposed by the Home Office. The Commissioner, Sir W. W. Mackenzie, finds that modification is required since the proposed prohibition of dry rubbing down would make it impossible to deal with painted surfaces of iron and steel work. Otherwise the Regulations as amended by him are substantially unaltered. They lay down that lead paint must be provided in the form of paste or of paint ready for use, and not in the dry state; that lead paint shall not be applied in the form of spray in the interior of buildings; that dry rubbing down and scraping except on iron or steel work shall not be done, if the surface be covered with lead paint; that washing facilities must be provided and also cloakrooms; and that periodic medical examination may be called for in cases of need.

Whether the code can practicably be enforced in the house painting trade with work carried on for a few days here and for a few days there and not anywhere for long remains to be seen. It seems feeble action in reply to the advice of a strong committee that the use of lead in paint should be prohibited, to the decision of the Geneva Convention that the use of lead in paint used on the interior of buildings should be prohibited, and finally to the advice of another committee that the Geneva Convention should be adhered to. However, the rapidly increasing use of spray paints not containing lead promises before long to solve the vexed problem, by stopping any call for lead paints from the industry.

The report contains in the form of an appendix a useful piece of research work carried out into the question of the generation of lead dust when metal surfaces are chipped and scraped. The report made by the Commissioner as to the proposed prohibition of dry rubbing down of these surfaces is based upon this investigation.—E. L. C.

Industrial Accidents and Disease in Bavaria. *F. Koelsch. Abstr. as follows from Zentralbl. f. Gewerbehyg., May, 1927, N. S. vol. 4, pp. 170–174, in Bull. Hyg., Nov., 1927, vol. 2, p. 884.*

This paper, while dealing mainly with the results in Bavaria of notification and compensation for the eleven forms of industrial disease or poisoning as now required in Germany, insists on the amount of instruction on the subject necessary for medical men, employers, and insurance offices, in order to carry out the duties properly. No cases of skin cancer were reported in Bavaria but there were two cases of carcinoma of the bladder, one from contact with beta-naphthylamine and the other from beta-naphthol. Of four cases of X-ray injury two were skin lesions and two severe anemia. Koelsch refers to other industrial maladies, excluded from the German list but scheduled in British Workmen's Compensation Acts, such as miners' nystagmus and dermatitis.

Workers' Compensation Act, 1926: Some Medical Aspects. *R.*

J. Millard. Abstr. as follows from Med. Jour. Australia, April 16, 1927, vol. 1, pp. 562–564, in Bull. Hyg., Nov., 1927, vol. 2, p. 885.

The Workers' Compensation Act which came into force on July 1, 1926, in New South Wales, Australia, is an important piece of medical legislation. An innovation is that a Workers' Compensation Commission is constituted by the Act and is intended to simplify and shorten legal procedure. Compulsory insurance by the employer against his liabilities is another new feature; while vocational reeducation and rehabilitation of a disabled worker may be paid for by the Commission. Such medical benefits as may, in the opinion of the Commission, reasonably be required, must be forthcoming, including nursing, drugs, and curative apparatus. The cost to the employer shall, however, be limited to £50. If the employer fails promptly to provide the treatment, the worker may do so at the expense of the employer, but he must first request the employer to furnish it. The Act establishes that the injured worker has a legal right to treatment, that the cost of such treatment is payable by the employer, and that a public hospital may recover from the employer the cost of treatment. Under these circumstances the question must arise as to whether the visiting medical staff should be in any way remunerated. The Act, while based upon British legislation, appears to be somewhat in advance of it.

LEGAL SIGNIFICANCE OF "TRAUMATIC NEUROSIS." *Knoll. Deutsch. med. Wchnschr., Jan. 14, 1927, vol. 53, p. 117.*

COMPENSATION IN SO-CALLED TRAUMATIC NEUROSES. *H. Kleist. Klin. Wchnschr., July 9, 1927, vol. 6, p. 1317.*

PNEUMONIA NOT DUE TO OCCUPATIONAL INJURY. *Von Schnizer. Med. Klin., June 30, 1927, vol. 23, p. 992.*

TUBERCULOSIS DUE TO OCCUPATIONAL INJURY. *Von Schnizer. Med. Klin., July 8, 1927, vol. 23, p. 1033.*

PHYSICIAN'S RELATIONSHIP TO WORKMAN'S COMPENSATION LAW. *A. F. McBride. N. J. Med. Soc. Jour., March, 1927, vol. 24, p. 170.*

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

REPORT OF THE DELEGATION APPOINTED TO STUDY INDUSTRIAL CONDITIONS IN CANADA AND THE UNITED STATES OF AMERICA. *Ministry of Labour. H. M. Stationery Office, 1927, pp. 117. Cmd. 2833. Abstr. as follows in Bull. Hyg., Nov., 1927, vol. 2, pp. 883–884.*

This report is one of great interest in establishing a contrast between industrial conditions in Great Britain and in America. Considerable attention is devoted to differences in the economic situations and a little attention is even given to medical questions. The absence of any national health insurance in the United States is noted, and a tendency for some trade-unions to provide sickness benefit. Some employers also arrange for free medical attention. In this matter insurance companies have exercised considerable force in improving industrial conditions. Large plants frequently have a resident medical man with a staff of nurses. Small plants, in some cases, are joining together to finance similar services. Legislation granting work-

men's compensation exists in forty-two states, and the insurance companies inspect and educate for the purpose of reducing chances of accidents; they grant lower premiums where favorable conditions prevail. Shop committees exist in many factories to further health and safety measures. The costliness of labor turnover has been an important influence at work. Factory legislation is framed and administered by each separate state; it is not a matter of federal legislation. Hence there is no uniform factory code. New York State alone has 200 inspectors, a staff about equal to the inspectorate of Great Britain. The inspectors are rapidly becoming experts, and are maintaining a high standard of health conditions. [What is said on industrial health questions in this report is important; the curious point is that so little is said. It only appears in an appendix and is omitted from the main report. Yet it is one of the distinctive features of American industrial life today. High wages and compensation costs are driving the employer of labor to provide for the health of his workers. He is, moreover, being profoundly influenced by great insurance companies which grant lower premiums to those who look well after their workers, and particularly by the Metropolitan Life Insurance Company, which cares for 35 million lives. Moreover, a new class of medical practitioner has sprung into existence, the factory medical officer; he is to be found working whole time in nearly every fair-sized factory.]

UNIFICATION OF LOCAL HEALTH SERVICES. II.—THE FACTORY MEDICAL SERVICE. *E. L. Collis. Brit. Med. Jour., Nov. 19, 1927, vol. 2, pp. 926-927.*

Factory medical service in Britain is today directed from London through medical and other technical inspectors who enforce the health provisions of the Factory Acts. Similarly certifying factory surgeons are appointed by and supervised from London. In the new Factory Bill now before Parliament the certifying factory surgeons of the past are to become "appointed doctors," who, apparently, are to be selected by the factory and appointed to act from London. This plan should greatly advantage the service and lead to its voluntary expansion. The new Bill also contains a proposal to transfer to local health authorities the duties of appointed doctors, but this proposal the writer views with great disfavor as crossing the lines of efficient action and tending to perpetuate the existing plan of inflicting a medical service on unwilling employers, a plan which has acceptedly failed. Moreover, factory medical service differs from other local medical services in that it is directly remunerative to the employers, so it should not be paid for out of the rates. A factory medical service should be as much part of factory organization as are engineering, management, and technical production; and no legislation should interfere with this natural line of development.

THE EFFECT OF EARLY INDUSTRIALISM ON THE HEALTH OF THE COMMUNITY. *M. C. Buer. Brit. Med. Jour., Nov. 12, 1927, vol. 2, pp. 874–875.*

The view is countered that industrialism between 1760 and 1860 exerted

an entirely noxious influence. First the population of Britain grew in that period at an unprecedented rate. The death rate fell from about 35 per thousand to about 20 per thousand in 1815; and whereas the birth rate had previously been below the death rate, the position became reversed. At the same time the mortality among children fell greatly; thus whereas 75 per cent. of those born in London used to die before attaining the age of 5, by 1825 the proportion had fallen to 30 per cent. In 1758 for every 1,000 births twenty-four mothers and sixty-six infants died. The vital statistics of the mid-nineteenth century only appear appalling when compared with subsequent years and not with those of earlier times. With economic advance came improved hygiene, both movements toward a higher civilization. Still in India and China agricultural and industrial methods remain ancestral, as does preventive medicine. The author of this interesting article has dealt more fully with the subject elsewhere.[1]—E. L. C.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

MULESPINNERS' CANCER. CAUSES OF THE DISEASE. *A. Leitch. Reprinted from Letters to the Editor, The Times, Nov. 3, 1927.*

Sir,—The very rapidity with which the position regarding the occupational disease, mulespinners' cancer, was established has recently given rise to doubts of its stability. It was only at the end of 1922 that attention was first called (by Doctors Southam and Wilson of Manchester) to the unusually high incidence of cancer of the scrotum amongst cotton-spinners. The experimental investigations in progress at the Research Institute of the Cancer Hospital, London, had already demonstrated the cancer-producing properties of certain mineral oils, and the Manchester surgeons suggested that one of the chief agents responsible for the scrotal cancer was the lubricating oil thrown off by the revolving spindles in the spinning mule. Continuing their researches, the workers at the Cancer Hospital found that the noxious property existed not only in a wide range of crude petroleums but also in many of their heavier refined products such as lubricating oils.

With this information, together with the accumulated experience of the medical staff of the Factory Department in analogous diseases at his disposal, the Home Secretary (Sir William Joynson-Hicks) promptly appointed an expert Committee to investigate the question and to suggest possible remedial and preventive measures. The report of this Committee was issued by the Stationery Office early last year.[2]

Cancer of the scrotum is an uncommon manifestation of malignant disease: some 50 fatal cases occur yearly in England and Wales. More than a fifth of the total number are in mulespinners. It has long been recognized that chimney-sweeps, tar distillers, pitch workers, and paraffin refiners are specially prone to this comparatively rare cancer: it is generally accepted in medical science, decided by law, and clearly proved by laboratory experiment that the disease in these trades is due to the prolonged action of the soot, tar, pitch dust, and crude mineral oils respectively. Cancer of the scrotum in Scotland is associated with the shale oil refining industry. On the Continent the very few cases of scrotal cancer that have been recorded have

[1] Buer, M. C.: Health, Wealth and Population in the Early Days of the Industrial Revolution. London, George Routledge & Sons, Ltd., 1926.

[2] Report of the Departmental Committee Appointed to Consider Evidence as to the Occurrence of Epitheliomatous Ulceration among Mulespinners. London, H. M. Stationery Office, 1926, pp. 29.

occurred in workmen long subjected to soiling with mineral oils. Is mulespinners' cancer induced by mineral oils?

That lubricating oil—which can be shown to have cancer-producing properties—is thrown off from the spindles in sensible quantities immediately after oiling, and in occasional droplets even after some hours, was convincingly demonstrated to the members of the Committee, and they had the opportunity of seeing in several spinners, chosen at random, a well-marked oil zone on the clothing in the vicinity of the scrotum. It is possible, indeed quite probable, that many spinners succeed, consciously or unconsciously, in avoiding this local oil soiling, and if attention were directed solely to them—as has happened—it would be difficult, though not impossible, to implicate the oil.

Much emphasis has been laid on the fact that the workmen's feet (for they work barefooted) are continually covered with oil, and yet cancer of the feet is not produced, whereas the scrotum can receive minute quantities at the most. The explanation would appear to be that the scrotum is more vulnerable than other parts of the skin, and that large amounts of oils are no more dangerous than minute quantities. It is not the quantity of the substance but the length of time it is in action that matters; in cancers due to tar or oils the minimum period necessary is over ten years, with an average of about 40 years.

A further objection to the oil theory is that mulespinners' cancer is unknown in cotton-spinning districts in France and the United States of America. Leaving out of account various facts which tend to qualify this statement, it is undeniable that until 1922 neither the employers nor the officials of the workers' union in this country had any suspicion of the occurrence of mulespinners' cancer and might easily have denied its existence—as some did. It is conceivable that our attitude in 1922 may be the attitude of others in 1927.

Again, it is said that cancer of the scrotum does not occur in wool-spinners though the spinning mule is the same in both industries. I understand that the former statement is not accurate. Since the conditions of temperature and humidity in wool-spinning rooms do not necessitate the scantiness of clothing of the cotton-spinner, the vulnerable parts are less likely to be affected by oil spray.

Finally, in an endeavour to exculpate the lubricating oils one of the medical witnesses before the Committee attributes mulespinners' cancer to the uncleanly habits of the workmen and to the local friction caused by blue trousers, and his view has obtained a certain amount of support. If we remember that cancer of the scrotum is 100 times as common in spinners between the ages of 55 and 75 as it is in the general population, and that while we have records of scrotal cancer in mulespinners for over 30 years, the wearing of blue trousers has only recently become fashionable, we can discount the importance of that supposed factor. The trouser theory is further invalidated by the fact, elicited by the Committee, that in 25 per cent. of the cases the mulespinners' cancer occurs not on the scrotum, but on other parts of the skin, principally the arms, which are not subjected to the friction of trousers, blue or otherwise, but are subjected to the action of the oil.

From our general knowledge of industrial cancers we can predict that if perfectly preventive measures were adopted to-morrow mulespinners' cancer would not be abolished for several years to come; its incidence would only gradually decrease, for the essential damage, which will later declare itself as cancer in susceptible subjects, has already been done in the older generation. Thus doubt would grow stronger. The chief preventive measures suggested are some alteration to the present mules to confine the lubricating oil to its proper place—which may be a costly business—or to use lubricating oils that are devoid of the cancer-producing property. The latter will require prolonged investigation and experimentation. At present all the mineral oils are under suspicion, and lubrication experts may have to discover suitable mixtures of animal or vegetable oils. Fortunately, mulespinners' cancer, as a rule, gives premonitory signals long before its arrival, and with frequent medical examinations there is no reason, provided the workers cooperate, why it should ever be allowed to make its appearance.

J. I. H.
March, 1928

Mulespinners' Cancer. Incidence of the Disease. *E. M. Brockbank. Reprinted from Letters to the Editor, The Times, Nov. 23, 1927.*

Sir,—The problem of the causation of "Mulespinners' Cancer," about which Dr. Leitch wrote to you recently, is a difficult one. The disease has been closely watched in Manchester since 1906, when the late Dr. S. R. Wilson discovered for the first time that scrotal cancer occurred very commonly in the operatives of Lancashire cotton mills.

There is very definite evidence that mineral oil plays some part in its causation, and I accept this view. But this is not the sole cause. The disease is practically confined to Lancashire cotton operatives working on Egyptian and American cotton. They work in hot rooms and wear the minimum of clothes, and piece broken ends with one hand. It does not occur in men working on standard size mules spinning waste cotton or worsted, lubricated with mineral oil. They work in a cooler atmosphere than that of other mule rooms and wear more clothes than ordinary spinners do. They piece with two hands. It occurs also occasionally in men in cotton mills who do not work on mules, but it does not occur in similar operatives in worsted mills. No cases occurred in the last four years in the oilers, greasers, mechanics, or engineers in the many mills of the Federation of Master Cotton Spinners, yet the clothes of these workers are more saturated with oil than are those of the mulespinners. They wear more under-garments than mulespinners do, and are not subject to the same irritation from their overalls referred to below as spinners are.

An important fact bearing on the causation of the disease is that cancer does not occur in mulespinners on an adjoining part of the skin which is more subject to contact with oil than the scrotum can be, and yet cancer in this site occurred three times as often in 1910, 1911, and 1912 in the general male population as scrotal cancer did. Scrotal cancer has appeared in men after leaving the mill, but it is very doubtful if such cases can be attributed to causes acting during the spinning occupation, because many elderly people working at any trade suffer from a form of thickened skin which naturally tends to become cancerous.

Dr. Robertson, of Darwen, has pointed out that the important cause of mulespinners' cancer is probably persistent friction from the fork of the combination overalls worn by the operatives acting on a delicate portion of skin which is kept moist by natural, and perhaps unnatural, secretions (not washed off daily as they should be), and which also has rubbed into it from time to time in the course of years chemicals used in finishing the material of modern cotton-workers' overalls. When a cotton spinner has to piece a thread of ordinary yarn he leans over and not against the mule, balancing on the left leg to get at the broken thread, which he pieces with his left hand only, not with two hands. This movement, with the rigid brace on men, is very liable to pull the ridge where the two legs of the trousers join against the very part of the body where the cancer arises, and the piecer may do this as many as 100 times every hour of work according to the coarseness of the count being spun on the mules. The soft vest worn by the men in hot mill rooms does not reach far enough down in all, if in any, of the workers to intervene between the overalls and the skin. Such persistent friction, acting over many years on a tender piece of skin, is very likely, without any help from mineral oil, to cause irritation of the skin, which is often the forerunner of cancer. A belt round the waist diminishes or prevents such friction on the one spot, and it is a striking fact that belts, not braces, are worn by the mule workers of the Finer Cotton Spinners Association in France, where the mulespinners' cancer does not occur. No cases occur in the native spinners in hot climates who wear loin cloths.

Another important reason for attributing scrotal cancer in part to friction is, in my opinion, the fact that worsted mulespinners and ordinary waste spinners piece with two hands and not with the left hand only, and this requires them to bend the whole body over the mule with both feet on the ground,

and not to bend the left side only with the right leg off the ground. In this way the one-sided pull of the brace and trouser fork on the skin which is caused by the one-sided movement is avoided. It is also possible that the change from soft, undyed fustian to hard dyed cotton "finished" overalls may have added to the irritation produced by the friction.

Cancer of the skin never occurs in the feet of workers in a mule room, who are all barefooted: this is a striking fact, even allowing for the special nature of the skin of the sole, especially as compared with that of the scrotum, and for the uncommon occurrence of cancer on the foot in the general population. Dr. Leitch suggested that it is not quantity but length of time during which the oil acts that influences the production of cancer, but this can hardly apply to the freedom of the feet in mulespinners, because the many visits which I have paid to cotton mills convince me that the feet must be more or less oily from the very first day the operative walks as a lad barefooted into the mule room, the floor of which is covered with oil, until the day he leaves it for ever, perhaps 50 years later. It is exceedingly difficult to get oil out of a garment or boots, and cotton operatives certainly do not wash their feet in hot water daily.

It is possible that certain constituents of mineral oil acting on a skin at an abnormally high temperature for eight or nine hours a day disturb the normal growth control and normal skin secretions and start a cancerous process in certain people. But temperature is not the all-important factor in England, because colliers working down hot pits with only shorts on are remarkably free from scrotal cancer. Investigations into the causation of cancer by mineral oil, developing those already undertaken by Dr. Leitch, are being actively carried out in the University of Manchester by the scientific staff of the Manchester Committee on Cancer, of which committee I am a member, and some promising results have already been obtained.

SPINNERS' SCROTAL CANCER. *J. Robertson. Lancet, Dec. 10, 1927, vol. 2, pp. 1273–1274.*

MULE-SPINNERS' CANCER. *Ibid., pp. 1249–1250.*

This article by Dr. Robertson, Medical Officer of Health for Darwen in Lancashire, is reproduced from his annual report where it might have escaped notice. The argument and facts set forth in his article in THIS JOURNAL (1927, vol. 9, p. 217) are quoted and maintained; and the conclusions arrived at by the Home Office Departmental Committee are again challenged. Further observations are held to confirm the view that spinners' cancer is due not to oil thrown off on to the overalls from the revolving spindles, but to friction from the fork of hard blue or white overalls acting upon the scrotum each time the spinner leans over the faller shaft to piece; this action is repeated 200 to 240 times an hour for five and one-half days each week. Where belts are used, instead of braces, to keep up the overalls, the friction caused by the pull on the overalls in leaning over is lacking and so are cases of cancer. Further, the opinion of Dr. L. Savatard is quoted that "ichthyosis is an important aetiological factor in mule-spinners' cancer. Though I do not deny that scrotal cancer does arise apart from ichthyosis, I am convinced that the great majority of such patients will give evidence of an ichthyotic skin." The author holds that if braces were discarded for belts and if personal cleanliness of the skin were rigidly and daily insured, spinners' cancer would be abolished.

The opinions expressed are, however, countered in an editorial annotation, in which the observations are quoted (1) of Dr. A. Scott on a kindred condition among workers in the Scottish shale oil industry in proof of

the existence of special skin sites susceptible to this type of cancer, and also (2) of Dr. Leitch that the lubricating oil used has proved carcinogenic for mice.—E. L. C.

Spinners' Cancer. *R. P. White. Lancet, Dec. 24, 1927, vol. 2, p. 1366.*

Spinners' Cancer. *E. L. Collis. Ibid., Dec. 31, 1927, p. 1418.*

The first of these letters attacks Dr. Robertson's views as expressed in This Journal (1927, vol. 9, p. 217), since the author maintains that physical injuries, however long-continued, have not been proved to be capable alone of originating cancer. Carcinogenic substances must possess specific physicochemical qualities. The friction of overalls may assist by denuding the protecting corneous layer of the skin and so permitting the specific oil to gain access to the deeper cells.

The second letter also attacks these views, stating, on the authority of F. L. Hoffman, that spinners' cancer does occur in America. In the United States, overalls are held up by belts, instead of by braces, as in Lancashire, and so, when the spinner leans forward to piece broken threads, the overalls cannot exert friction on the scrotum. Dr. Robertson had claimed the supposed nonoccurrence of spinners' cancer to be in favor of his views.—E. L. C.

Industrial Aspects of Rheumatism. *L. J. Llewellyn. Jour. State Med., Sept., 1927, vol. 35, pp. 513–521.*

Attention is drawn first to the loss in industrial efficiency and national economy caused by sickness, and then to the proportion of this loss due to rheumatic conditions and heart disease. Slow capacity for adaptation to everchanging climatic environment is held to predispose to rheumatism and to be associated with endocrine-sympathetic inadequacy or instability. One-sixth of total sick benefit, or £2,000,000 annually, is paid in Great Britain on account of rheumatic disorders. This amount could be reduced greatly and Approved Societies in their own interest should provide the required hydrotherapy; even pithead baths might be utilized for the purpose. Physical therapy not merely treats and ameliorates, it also prevents; it trains the person to react rapidly to those climatic changes which are so frequent in Northern Europe.—E. L. C.

A Case of Paralysis of the Left Vocal Cord, with Mitral Stenosis, in a Teacher. *B. Kogan. Gigiena Truda, 1926, no. 3, pp. 61–63.*

The case described came under observation in the summer of 1925 in a sanatorium at Kislowodsk. The patient was a teacher, aged 34, who had practised her profession for sixteen years. Her history showed numerous infectious diseases. Her voice began to lose its tone in the spring of 1910, but during vacation, with cessation of work, it fully returned. Year by year, however, she gradually lost her voice and, in the summer of 1925, gave herself up for treatment in the Caucasus. Fully compensated heart trouble and paralysis of the left vocal cord, due to pressure on the left recurrent laryngeal nerve, were found. Apparently her profession had an important bearing on the etiology of the vocal cord paralysis.—M. G. P.

CIRCULATORY SYSTEM

PROGNOSTIC STANDARDS FOR HEART DISEASE IN RAILROAD EMPLOYEES. *F. A. Waples. Texas State Jour. Med., Oct., 1927, vol. 23, pp. 409–411.*

This paper is a study of the usual chronic heart disease seen in a railroad surgeon's service, with a view to evaluating the prognostic elements so as to furnish a practical guide to definite decision as to fitness for railroad service.—B. A.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

DELETERIOUS ACTION THROUGH THE SKIN OF POISONOUS GASES AT HIGH CONCENTRATIONS (CARBON MONOXIDE, HYDROGEN SULPHIDE, HYDROCYANIC ACID, AND ANILINE). *W. Schütze. Abstr. as follows from Arch. f. Hyg., 1927, vol. 98, pp. 70–83, in Chem. Abstr., Sept. 20, 1927, vol. 21, p. 3085.*

Healthy full-grown cats were placed in a specially designed gas chamber in such a way that pure air was breathed, but the skin of the rump and extremities was exposed to the gas under investigation. Neither carbon monoxide, at a concentration of 14 volumes per cent., nor aniline at 2.2 mg. per liter, had any noticeable effect. Hydrocyanic acid, at a concentration of 2 volumes per cent., caused the death of the animal in 2 hours 26 minutes, with the symptoms of cyanide poisoning. When the arms of the experimenter were exposed for 27 minutes to a mixture containing 5.5 volumes per cent. hydrocyanic acid, bright red blotches appeared, and there was headache and discomfort. When the arms were similarly exposed for 60 minutes to 100 per cent. hydrogen sulphide, the skin was darkened, there were itching spots, red blotches, and after several hours erythema. The skin of guinea-pigs exposed to this gas likewise developed erythema. —P. D.

EXPERIMENTAL STUDIES ON THE EFFECT OF SIMULTANEOUS WORK AND EXPOSURE TO POISONOUS GASES UPON THE ANIMAL ORGANISM. *W. Lütkens. Abstr. as follows from Arch. f. Hyg., 1927, vol. 98, pp. 59–69, in Chem. Abstr., Sept. 20, 1927, vol. 21, p. 3085.*

The more rapid breathing of cats forced to exercise causes a corresponding increase in the poisonous effect of hydrogen chloride and carbon tetrachloride, respectively, an irritating and a narcotic gas. The secretion of saliva is provoked more promptly by hydrogen chloride in animals which have previously been exposed to this gas. Experiments upon resting animals gave maximum resistance to the effect of poisonous gases.—P. D.

HANDLING OF FLUIDS LIABLE TO GIVE OFF POISONOUS VAPORS. *Eibel. Abstr. as follows from Zentralbl. f. Gewerbehyg., April, 1927, N. S. vol. 4, pp. 100–114, in Bull. Hyg., Nov., 1927, vol. 2, pp. 878–879.*

This article deals with the many different ways of emptying vessels containing fluids capable of giving off

poisonous gases or fumes, without harm to those manipulating them. The author starts with simple means of transport, protection by means of absorbent materials against breakage, and passes in review methods of pouring, syphonage, uses of compressed air, details of valves, and the like. All the various types of apparatus are illustrated in diagrammatic form in thirty-two drawings. Most stress is laid on the necessity of limiting as far as possible the superficial area of the liquid from which fumes might be evolved, any violent movements of the fluid, and splashing. He insists too on the desirability of reducing complication of the parts in the apparatus to a minimum, and on instruction of the persons charged with the manipulations as to the risk of burns and absorption through the skin. [He does not describe particularly what the dangerous gases and liquids are.] Engineers, managers, and foremen in chemical and explosive works are likely to find the article useful.

PROTECTION AGAINST TOXIC EMANATIONS. *P. Tambute. Abstr. as follows from Chim. et indust., May, 1927, Special No., pp. 743–745, in Chem. Abstr., Oct. 20, 1927, vol. 21, p. 3404.*

Brief description of the A. R. S. gas mask and of various modifications thereof.—P. D.

MEASURES AGAINST ARSINE AND PHOSPHINE POISONING. *C. Naeslund. Abstr. as follows from Upsala Läkaref. Förh., May 31, 1927, vol. 32, p. 367, in Jour. Am. Med. Assn., Sept. 10, 1927, vol. 89, p. 924.*

A number of different methods for the removal of arsine and phosphine from air or hydrogen were investigated by Naeslund and most of them were found to be ineffective. He recommends as the most suitable for both arsine and phosphine: 1. Concentrated aqueous solution of potassium permanganate for purification of small amounts of air or hydrogen. 2. Filter medium, consisting of a well-moistened mixture of 2 parts by weight of powdered potassium permanganate and 3 parts by weight of clean coarse sand, for treating large quantities of air or hydrogen. 3. Filter medium for gas masks prepared by stirring 10 parts by weight of crushed potassium permanganate in 8 parts of 10 per cent. silver nitrate solution. The mixture is then dried and mixed with 1 part by weight of calcium oxide. This mass may be introduced into ordinary containers which can be fastened to the proper gas mask for the purpose. —K. R. D.

FATTY SUBSTANCES IN BENZINE POISONING. *N. Schustrow and F. K. Letawet. Abstr. as follows from Deutsch. Arch. f. klin. Med., March, 1927, vol. 154, p. 180, in Jour. Am. Med. Assn., July 2, 1927, vol. 89, p. 74.*

Schustrow and Letawet continued their experiments on the relation of fats and lipoids to benzine poisoning. They conclude that the lowered amount of cholesterol in the blood protects against the action of benzine. They believe that a fatty diet is injurious in such subjects.—K. R. D.

AUTOMOBILE EXHAUST GAS POISONING IN CHILDREN. *J. C. S. Battley.*

Am. Jour. Pub. Health, Oct., 1927, vol. 17, pp. 1024–1026.

Even though the author has not presented definite proof that children are poisoned in the streets and while riding in automobiles, he hopes that by presenting his views he will awaken a wider interest in the problem.—P. D.

Chronic Carbon Monoxide Poisoning. *H. G. Beck. Abstr. as follows from Ann. Clin. Med., June, 1927, vol. 5, p. 1088, in Jour. Am. Med. Assn., Nov. 5, 1927, vol. 89, p. 1635.*

Beck calls attention to the fact that the condition designated chronic carbon monoxide poisoning is widespread and far more prevalent than is generally supposed, and emphasizes the various clinical phenomena which result from long periods of, or frequent exposures to, mildly toxic or sublethal doses of the gas.—K. R. D.

Carbon Monoxide Poisoning. *W. C. Jones and J. O. Pinkston. Abstr. as follows from New Orleans Med. and Surg. Jour., Aug., 1927, vol. 80, p. 99, in Jour. Am. Med. Assn., Oct. 15, 1927, vol. 89, p. 1366.*

The diagnosis of carbon monoxide poisoning, Jones and Pinkston point out, rests mainly on (*a*) history of possible exposure, (*b*) presence of carbon monoxide in the blood either before or after death, and (*c*) at autopsy (1) preservation of the body from decomposition, (2) a bright red color of the organs and tissues of the body including the blood, and (3) the fluidity of the blood. For the demonstration of carbon monoxide in the blood they recommend especially of the older tests those with potassium ferrocyanide, mercuric chloride, zinc chloride, ammonium sulphide, lead subacetate, tannic acid, trinitrophenol, heat, and simple dilution. Tests with phenol and with alum are the best. More than one test should be made on each unknown specimen. Each test should be made several times with different amounts of the reagents and various dilutions of blood.—K. R. D.

The "Salvoxyl" Apparatus for Treatment of Carbon Monoxide Poisoning. *H. Engel. Abstr. as follows from Reichs-Gsndhtsbl., 1927, vol. 2, pp. 290–291, in Bull. Hyg., Nov., 1927, vol. 2, p. 887.*

This is an official repudiation by the Imperial Health Office in Berlin of the claims made on behalf of an apparently patented apparatus for the administration of oxygen by subcutaneous injection. The claim was made that the "Salvoxyl" [for so it is called] was widely used in France and in the coal mines of Belgium. Dr. Engel has no difficulty in showing that oxygen injected into the subcutaneous tissue is far less likely to reach the blood than that inhaled through the lungs. The apparatus itself generates the oxygen and the pressure at which it can be administered is again an argument against its use. It is only likely to be of any use where cylinders of compressed oxygen are unobtainable.

Resuscitation in Carbon Monoxide Poisoning in Monkeys. *S. Jellinek. Med. Klin., Jan. 14, 1927, vol. 23, p. 57.*

Chlorine Gas Poisoning. *G. Lutz. Abstr. as follows from Zentralbl. f. Gewerbehyg., May, 1927, N. S. vol. 4,*

pp. 175–176, in Bull. Hyg., Nov., 1927, vol. 2, p. 881.

Lutz describes disappearance in himself, after rather severe gassing from chlorine, not only of the unpleasant smell but also of chest symptoms, lacrimation, salivation, loss of energy, etc., after taking strong coffee. He therefore advocates caffein as a remedy of great value in chlorine gassing. Even after absence on holiday for some weeks he remained immune from recurrence of the symptoms.

MECHANISM OF HYDROGEN SULPHIDE POISONING. *G. Rodenacker. Abstr. as follows from Zentralbl. f. Gewerbehyg., May, 1927, N. S. vol. 4, pp. 176–178, in Bull. Hyg., Nov., 1927, vol. 2, pp. 881–882.*

The sudden unconsciousness following on inhalation of doses of 10 parts per 10,000 of sulphuretted hydrogen gas has been usually attributed to its paralyzing effect on the central nervous system. The author tries to prove [successfully in the reviewer's opinion] that the unconsciousness and death is due to action on the blood by interference with its oxygen carrying power and so leading to tissue suffocation. In this, in his opinion, it resembles hydrocyanic acid.

He illustrates his belief by a film showing guinea-pigs exposed to 1.5 to 10 volumes of hydrogen sulphide per 1,000 of air. After inhalation for forty seconds he is able to save the animals by intracardial injection of iron preparations while the control animals succumb. The sulphuretted hydrogen gas attacks the red blood corpuscles; it is no specific poison but has a catalytic action. The tissues lose the power of absorbing the oxygen brought to them. He was able to demonstrate Barcroft's phenomenon of suffocation in a characteristic diminution in the size of the spleen in twelve mice. Six of these were poisoned by chloroform and their spleens weighed 0.65 gm. while the spleens of six poisoned by hydrogen sulphide weighed 0.47 gm. He cured hydrogen sulphide conjunctivitis in man with electroferrol, reducing absence from work from three days to one-half or one day.

FATAL CASE OF POISONING BY METHYL BROMIDE. *J. Adler-Herzmark. Abstr. as follows from Zentralbl. f. Gewerbehyg., May, 1927, N. S. vol. 4, p. 161, in Bull. Hyg., Nov., 1927, vol. 2, p. 881.*

Describes a fatal case of methyl bromide poisoning (CH_3Br) in a man 37 years old engaged for several hours in emptying fluid containing this chemical. He had disregarded the mechanical suction apparatus provided for the purpose. The importance of the case is that the substance is employed in a certain class of fire extinguisher (see following abstract). As in a previous case the symptoms came on sixteen hours later with cramp-like and, subsequently, epileptiform seizures. Taken to hospital he died without regaining consciousness. [Six cases of this form of poisoning have been recorded since 1890—all but the present one in the manufacture of the material.]

RISKS ATTENDING THE USE OF PATENT CHEMICAL FIRE EXTINGUISHERS. *W. E. v. Gronow. Abstr. as*

follows from Zentralbl. f. Gewerbehyg., May, 1927, N. S. vol. 4, pp. 161–166, in Bull. Hyg., Nov., 1927, vol 2, p. 881.

Describes the risks attending the use of the different kinds of fire extinguishers depending on (1) carbon tetrachloride, (2) methyl bromide, and (3) foam producing saponine compounds.

Carbon tetrachloride is five times as heavy as air, is almost incombustible, and is not explosive. The vapor given off from 2 liters in a completely closed room of 55 cu. m. capacity (*i.e.*, a moderate-sized room) corresponding with 9 c.c. per liter of air breathed is considered capable of inhalation for "several minutes" without danger. But more than 2 liters should not be used, or if it is then smoke helmets with suitable connections should be employed. This type of extinguisher is useful for factories in which benzine, benzol, petroleum, lacquers, resins, carbide, naphthalene, and the like materials are present, in the case of which, under the action of fire, chlorine gas, hydrochloric acid vapor, and even phosgene (under restricted conditions) might be developed. It finds its greatest usefulness in garages and rubber factories.

Methyl bromide is three times as heavy as air; is useful against benzine, benzol, petroleum, acetone, oils, spirituous liquors, and is especially useful against film fires.

Extinguishers producing foam or froth from saponine substances do so from the addition and generation of carbonic acid gas from the interaction of bicarbonate of soda and a mineral acid. The saponines are colloidal substances of wide distribution in the plant world, *e.g.*, *Saponaria officinalis*. The carbonic acid gas given off in the reaction becomes imprisoned in the foam and, falling down, blankets the burning objects. These extinguishers are recommended especially for industries using spirits, benzines, benzol, lacquers, etc., for oil fired ships, tank vessels, and chemical factories; they are contraindicated in electricity works.

THE LATEST ACHIEVEMENTS IN THE PROTECTION OF WORKERS IN LEAD PAINT MANUFACTURE. *B. Kojransky. Gigiena Truda, 1926, no. 3, pp. 29–37.*

The efforts of the People's Commissariat of Labor to protect the health of workers employed in the manufacture of paint have led to two results: (1) Mechanical methods have been introduced in factories where lead is still used. Besides lessening the hazard, mechanization has resulted in great economy; the number of workers has been reduced from 1,000 to thirty and the time of manufacture of white lead, from fifteen days to from twelve to twenty-four hours. (2) Factories have been established in which zinc oxide has been substituted for white lead. There is such a plant in operation in Jaroslaw with a yearly output of 3,280 tons of zinc oxide. The introduction of zinc oxide allowed the use of white lead to be limited by enactment and the term for the gradual suspension of the manufacture and use of white lead to be cut short.—M. C. S.

CURRENT VIEWS ON CAUSATION OF LEAD POISONING. *P. Schmidt. Abstr. as follows from Zentralbl. f.*

Gewerbehyg., May, 1927, N. S. vol. 4, pp. 180–182, in Bull. Hyg., Nov., 1927, vol. 2, p. 870.

The author—a high authority—discusses the present position of experimental and clinical knowledge on the causation of lead poisoning. He enters into the difficulties in diagnosis, the unsatisfactory nature of the four leading characteristics—the blue line, the facies, punctate basophilia, and the presence of hematoporphyrin in the urine. He accepts the view of lead absorption as distinct from lead poisoning, and speaks of "quite healthy lead carriers." He is seeking a method of demonstrating lead poisoning and not lead absorption, which is all that the various tests do now unless wrist drop is present, or terminal symptoms following granular kidneys. What he is aiming at he calls "micro-analysis" of the lead in the excreta and organs. He only outlines the method, giving a full description in the *Deutsche medizinische Wochenschrift* [see THIS JOUR., 1927, vol. 9, Abstr. Section, p. 173]. It is colorimetric, demonstrated after conversion of the lead into lead peroxide, and then, by aid of the Arnold-Menzel-Trillat reagent, production of a blue color (from reduction of the peroxide) due to the presence of lead. Qualitative control is made by means of Löwe's spectrograph enabling determination of lead qualitatively to be made in amounts as small as a thousandth of a milligram.

THE BLOOD CHANGES IN CHRONIC LEAD POISONING. *L. Schmidt-Kehl. Arch. f. Hyg., 1927, vol. 98, pp. 1–22.*

Lead has no clear hemotropic action in cats. With guinea-pigs the daily administration *per os* of 8 mg. of lead per kilogram of body weight causes an increased output of urobilin in the feces as the first indication of blood cell destruction.

In man the administration *per os* of $\frac{1}{2}$ mg. of lead per kilogram of body weight daily over a period of three weeks caused an increased urobilin content of the feces. In the first stages of lead poisoning blood regeneration is not markedly above normal. With increased blood destruction there is at first a slight decrease in the blood cell count, followed later by a marked diminution. Accompanying the blood cell destruction there is regeneration in the bone marrow and granular erythrocytes appear, which in a qualitative sense indicate blood regeneration. For practical purposes the granular erythrocytes are valuable diagnostic indication. Accurate counting has little meaning for their number varies considerably within twenty-four hours.

In contrast with Lehmann's findings with guinea-pigs, the author found no increase in granulation with coal or cement workers or alcoholics. —L. T. F.

SIGNIFICANCE OF BLOOD CHOLESTERIN IN LEAD POISONING. *E. Kühn. Abstr. as follows from Zentralbl. f. Gewerbehyg., April, 1927, N. S. vol. 4, pp. 117–129, in Bull. Hyg., Nov., 1927, vol. 2, p. 872.*

The author has taken pains to try and settle the question of how far determination of the cholesterin in the blood helps in the diagnosis of lead poisoning. Kretschmer had stated in a series of cases of plumbism that the cholesterin content in the total blood

was higher than in the serum whereas normally the reverse was the case. The author, in forty cases of chronic lead poisoning, gives in tabular form details in regard to each one of the following points: (1) kind and duration of employment; (2) symptoms; (3) and (4) cholesterin content in 100 c.c.: (*a*) in total blood; (*b*) in the serum; (5) facies; (6) blue line; (7) hemoglobin; (8) punctate basophilia; (9) hematoporphyrin; (10) blood film appearances. His conclusions are that the cholesterin content of the serum falls in acute cases, and on this hypocholesterinemia there follows, usually, a hypercholesterinemia. In the total blood the cholesterin content was frequently higher than in the serum, but it was not found so frequently in excess as to make its value when present of specific importance in the diagnosis of lead poisoning.

THE DIAGNOSIS OF LEAD POISONING. *O. Stickl. Arch. f. Hyg., 1927, vol. 98, pp. 43–58.*

Each typical symptom of lead poisoning can be present or be lacking. The kind and number of symptoms, their frequency, and the intensity of manifestation appear to be dependent on constitution, earlier disease, and mode of life. Investigation of lead workers must include physical examination, investigation of the urine and of the red and white blood cells in order definitely to establish the disease. —L. T. F.

LEAD HAZARDS. *J. P. Leake. Jour. Am. Med. Assn., Oct. 1, 1927, vol. 89, pp. 1105–1107.*

Leake reports failure to find evidences of lead poisoning from the use of ethyl gas after exposures approximating three years. Lead having been found in the dust of ordinary garages, various industrial establishments were investigated—cracker and cake factory, underwear factory, shirt and overall factory, machine shop, retail grocery, dairy, ice cream plant, etc.—and in the air of all lead dust was found.

Muscle strength tests in the group of muscles most commonly affected in lead palsy indicated that in lead poisoning the flexors show as much weakness as the extensors, and the left or less used hand as much loss of power as the right or more used hand. Stippling of red cells showed a remarkable parallelism with apparent lead absorption, and, when carefully carried out, is, in the author's opinion, the most important single clinical check on lead absorption.—K. R. D.

THE STUDY OF LEAD POISONING IN AN ENAMELING PLANT. *W. S. Leathers and H. J. Morgan. Jour. Am. Med. Assn., Oct. 1, 1927, vol. 89, pp. 1107–1112.*

This study is summarized as follows:

> A careful physical examination of thirty-nine employees in an enameling plant led to a definite diagnosis of plumbism in fifteen cases (39 per cent.), and a diagnosis of probable lead poisoning in eleven cases (28 per cent.). . . . .
>
> The chief cause of lead poisoning was the breathing of lead laden dust resulting from the spraying of pieces of iron stoves with enamel mixture. This was done in booths, spray guns being used from which the mixture was discharged under 80 pounds of pressure.
>
> The following corrective measures were instituted: (1) personal hygiene; (2) cor-

rection of unhygienic conditions in the plant; and (3) adequate medical supervision.

The importance of obtaining morbidity reports of occupational diseases is obviously a need with the increased expansion of industry.

THE EFFECT OF MANGANESE ON GROWTH. *R. McCarrison. Abstr. as follows from Indian Jour. Med. Res., 1927, vol. 14, pp. 641–648, in Bull. Hyg., Oct., 1927, vol. 2, p. 799.*

Manganese is known to be a substance of physiologic importance, and in view of the fact that wheat contains more of this element than does rice, and at the same time has a greater nutritive value, it was thought to be worth while to investigate the effect, on the growth of young animals, of the addition of small quantities of manganese salts to their diets. The basal diet used in these feeding experiments was composed of meat residue, starch, salt mixture, and yeast or marmite, with either butter or a mixture of olive and cod-liver oil. In the first experiment, 0.889 mg. of manganese dioxide daily was found to retard the growth of the young rats, while in the second experiment, 0.0327 mg. of the soluble manganese chloride increased the rate of growth. It is suggested therefore that the growth promoting property of whole wheat is in part due to its comparatively high content of manganese.—P. D.

AN INVESTIGATION OF THE EFFECT UPON RATS OF LONG-CONTINUED INGESTION OF ZINC COMPOUNDS, WITH ESPECIAL REFERENCE TO THE RELATION OF ZINC EXCRETION TO ZINC INTAKE. *K. R. Drinker, P. K. Thompson, and M. Marsh. Abstr. as follows from Am. Jour. Physiol., July, 1927, vol. 81, pp. 284–306, in Jour. Am. Med. Assn., Oct. 1, 1927, vol. 89, pp. 1177–1178.*

Drinker, Thompson, and Marsh have never observed any significant clinical symptom nor obtained any significant laboratory evidence of damage resulting from the daily ingestion by rats, during long periods of time, of zinc oxide, zinc acetate, zinc citrate, or zinc malate. Gross and histologic examination of tissues following autopsy has shown in the organs of rats treated with zinc no damage of any sort attributable to zinc. Studies on zinc excretion both in control and in zinc fed rats indicate that a small fraction of absorbed ingested zinc leaves the body in the urine but that the main bulk of it is excreted through the gastro-intestinal tract. Rats are able to excrete as much zinc as they ingest, even when the zinc dose is very large. This fact is true whether the ingested zinc be an organic zinc compound or the more insoluble zinc oxide.

TOXICITY OF ZINC. *V. G. Heller and A. D. Burke. Abstr. as follows from Jour. Biol. Chem., July, 1927, vol. 74, p. 85, in Jour. Am. Med. Assn., Oct. 8, 1927, vol. 89, p. 1282.*

Heller and Burke state that zinc added to a normal ration in the form of pure zinc dust, of zinc oxide, or of certain zinc salts, in amounts as great as ever found in contaminated foods, did not interfere with growth, reproduction, and normal functions of the rat through three generations. No pathologic conditions were found in the organs of rats fed the rations used in this experiment.—K. R. D.

DUST HAZARDS AND THEIR EFFECTS

DUST RESPIRATORS: THEIR CONSTRUCTION AND FILTERING EFFICIENCY. *S. H. Katz, G. W. Smith, and E. G. Meiter. U. S. Bur. Mines, Tech. Paper 394, 1926, pp. 52.*

"Respirators, or filters to prevent the inhalation of dust, have been used in various forms for centuries." The authors give a brief account of what may now be called ancient respirators and then follow with a description of the salient features of modern respirators as used in Great Britain, South Africa, Germany, and the United States.

The paper contains photographs and descriptions of eleven different respirators, of the Fogler flat filter (developed for chemical warfare), of a paint sprayer's mask and of a sand blaster's mask. A great many types of respirators and their filters were tested for filtering efficiency against tobacco smoke and fine silica dust. The tests were made by comparing the Tyndall effect of the suspension entering and leaving the respirator. For this purpose, the authors devised an improved pair of nozzles for their Tyndall box.

The subject matter in this bulletin is ably presented, the illustrations are excellent, the references are pertinent, and there are no unnecessary tables. The authors close with a two-page summary, of which portions are quoted herewith:

> The efficiencies of the industrial dust respirators in restraining tobacco smoke range from 5 to 33 per cent when the air is passed at a rate of 32 liters per minute; a gas-mask canister with two filters of absorbent cotton showed 63 per cent efficiency. The Fogler flat felt filter was most efficient, showing 97 per cent.
>
> The efficiencies against silica dust floated in air range from about 9 to 70 per cent for the dust respirators, or about twice the efficiency against the tobacco smoke; most of the silica particles were 1 micron in diameter or four times the diameter of the tobacco-smoke particles.
>
> As the laboratory tests of the dust respirators were severe, the low efficiencies given do not indicate the general efficiencies of these respirators under all industrial conditions. Much of the dust encountered in industry is less difficult to arrest, and the over-all efficiency of the respirators in actual service is correspondingly higher. The tests thus show that as a rule the respirators are of much value in removing injurious dust from inspired air.
>
> The discomfort caused by respirators covering the face—the heat engendered thereby, the irritation of the skin at contact with the respirators, and the resistance to the flow of the air breathed—are the most serious disadvantages of respirators. The resistances of industrial dust respirators to air flowing at 85 liters per minute were 0.25 to 1.5 inches of water. The Fogler flat felt filter had a resistance of 2.25 inches and the gas-mask canister 3.6 inches.
>
> Filters of various fabrics, including cheesecloth, canton flannel, unbleached muslin, closely woven bleached muslin, filter paper, and absorbent cotton, all made for test purposes so as to expose exactly 100 square centimeters of filter area, were tested against tobacco smoke and against silica dust in air flowing at a rate of 10 liters per minute. Each material was tested in a single layer and in multiple layers. Results showed that each layer of fabric (in effect) removes about the same proportion of smoke or dust that penetrates to it before the filters become clogged or altered by deposits of an arrested material, such as silica dust. Consequently, when the efficiency of a single ply of a filter is known, the efficiency of any multiple ply filter of that material may be calculated.
>
> The efficiencies of the filters were in-

creased by clogging with dust until eventually many filters gave an efficiency of 100 per cent.

The resistance of the filters to air flow increases in proportion to the number of plies of fabrics after the first ply. The first filter layer shows a somewhat higher resistance than the additional ones.

Air filters of high efficiency can be made with a sufficient number of plies of material that has a low efficiency per single ply—cheesecloth, for example. Such filters have less resistance to air flow than equally efficient filters made of fewer plies of the higher-efficiency materials, such as closely woven muslin.

A new type of dust respirator was designed and constructed according to the principles brought out in the tests. This respirator consists of a large filter of canton flannel made into a cap or turban for the head. Air filters through the canton flannel to the interior, passes through a check valve, and is then conducted through a rubber tube running over the forehead and between the eyes to the nose, which is covered with a small rubber nose cap. At an air flow of 85 liters per minute the efficiency of this respirator is 58 per cent against tobacco smoke and 93 per cent against silica dust. [The mouth is uncovered so that the wearer may talk freely or expectorate; freedom in these respects, according to many published statements, is desired by most workmen.]

Although the use of respirators should be encouraged among workers in dusty industries, a respirator can not be considered a final safeguard. In mining and in other industries efforts to prevent the formation of dust and its distribution by the air, by the use of hollow drill steel and water, and by sprays on the undercutting machines should be continued.

—P. D.

INSTRUCTIONS FOR SAMPLING ATMOSPHERIC DUST BY THE IMPINGER METHOD. *A. H. Emery. U. S. Bur. Mines, Information Circ. No. 6048, Sept., 1927, pp. 9 (mimeographed).*

This is a concise and very practical description of the impinger method of sampling dust in mine air as used by the Bureau of Mines. Preparation of the apparatus, calibration of the suction pump, preparation of sample bottles, selection of sampling points, collection of samples, the recording of conditions under which the sample was taken are given in considerable detail.

In the laboratory, the coarse particles in the aqueous or alcoholic suspension of dust are filtered through a 280-mesh screen, the filtrate is diluted to 500 c.c., and the particles contained in 1 c.c. are counted. By sedimentation the 500-c.c. suspension is separated into two fractions, one consisting of particles above 10 microns in size and the other of particles less than 10 microns. Each fraction is then estimated gravimetrically. Particle counts are given per cubic meter of air and weights in milligrams per cubic meter.—P. D.

RISK FROM INFLAMMABLE DUSTS. *P. Boulin. Ann. d'hyg. pub., indust. et sociale, Sept., 1927, pp. 557–566.*

Figures are given drawn from a conference held at Washington in 1926 of the danger arising from dust explosions, explosions due to the combustion of fine oxidizable dusts in air. Dust, if sufficiently fine, of all materials combustible in air, may be explosive; but the explosive property is inhibited if the dust is mixed with unoxidizable stone dust or if the air is replaced by an inert gas such as carbon dioxide. The smaller are the dust particles, the larger is the surface area presented to chemical action; fine grinding is today more usual than of old. Oxygen

absorption by particles renders them more easily combustible and so explosive. Metals such as aluminium, zinc, and magnesium form explosive dusts; and so do most organic materials. Three classes are given, of which the most explosive contains such things as sugar, coal, starch, cocoa, and flour; the second contains leather, sawdust, and semolina; and the third, tobacco, bone, and lampblack. Electric sparks are a danger where explosive dusts exist; therefore all apparatus should be well earthed; a humid atmosphere is also of value. Automatic apparatus for releasing an inert gas or fine rock dust are recommended to be installed.—E. L. C.

Silicosis in Derbyshire. *P. Heffernan. Appendix II, Ann. Rep. County Med. Officer of Health, Derbyshire, for 1926.*

The author traverses some of the ground he covered in his contribution to This Journal (1926, vol. 8, p. 481); but fuller statistics are given of cases of silicosis treated at Matlock Tuberculosis Dispensary, whence the association of the disease with exposure to dust of Derbyshire gritstone is well established. Dr. Heffernan then turns to pocket silica sand of which the dust, although small enough and plentiful enough, is not found associated with the occurrence of silicotic fibrosis whether the test be X-ray examination or deaths from tuberculous silicosis. Some description is given of the geology of pocket silica sand and the suggestion is thrown out that the harmlessness of the dust may lie in the fact that the quartz grains are coated with a kaolinitic or clay material. Further experimental investigation is, however, pointed out to be required. Some further information is given regarding exposure to dust of chert and flint, both of which are particularly harmful. A useful summary table is given of Derbyshire industries involving risk of silicosis exhibiting the degree of risk present in each.—E. L. C.

Examination of Mine Employees, Western Australia. *D. G. Robertson. Health, Commonwealth of Australia, Nov., 1926, vol. 4, pp. 165–170.*

This is an account of the investigation by the Commonwealth Division of Industrial Hygiene into the physical condition of 4,068 metalliferous mine employees, Western Australia. The examinations were carried out under the provisions of the Miners' Phthisis Act (No. 16) of Western Australia. With the exception of one field, where lead ore was mined, all the mines were treating auriferous ore.

The investigation was divided into two periods: (1) employees engaged in the gold fields of Kalgoorlie, where the Health Laboratory with its modern X-ray plant was made the examining center; and (2) employees engaged in mines in other districts of Western Australia, examination being carried out by means of a portable X-ray plant which was sent to any convenient place in which suitable electric current was available and to which men from the surrounding mines came for examination.

The procedure and personnel for the examinations is described. Of the 2,980 persons examined at the Kalgoorlie Laboratory, 78 per cent. were found to be healthy with regard

to their pulmonary condition; 11 per cent., suffering from silicosis in an early stage and 7 per cent., in an advanced stage; 4 per cent., from silicosis plus tuberculosis; and 0.4 per cent., from pulmonary tuberculosis uncomplicated by silicosis. The average length of employment of the tuberculous and silicotic cases was twenty-six years for underground workers (82 per cent. of the whole) and twenty-one to thirty-three years for surface workers. Of the 1,088 employees examined by the portable X-ray plant, figures are completed for only 651, of which 88 per cent. were found to be healthy; 8 per cent. early and 2 per cent. advanced silicotics; and 2 per cent. showing silicosis plus tuberculosis.—B. A.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

ORIGIN OF BAKERS' ECZEMA. *C. Stern. Deutsch. med. Wchnschr., Aug. 19, 1927, vol. 53, pp. 1430–1431.*

Clinical observations and functional skin tests were made from which the author concludes that German flours, even with admixtures, are not responsible for the occupational eczema called bakers' dermatitis. The usual admixtures are to be considered harmless. Bakers' eczema is, therefore, strictly speaking, not an industrial eczema.—M. C. S.

FLAX DERMATITIS. *M. D'Agostino. Abstr. as follows from Semana méd., Sept. 8, 1927, vol. 34, p. 642, in Jour. Am. Med. Assn., Dec. 17, 1927, vol. 89, p. 2148.*

A number of laborers in the flax fields exhibited a dermatitis on the hands and feet. The cause was found by D'Agostino to reside in a wild chamomile mixed with the flax plants. —K. R. D.

TREATMENT OF ROENTGEN RAY EPITHELIOMA. *E. Marquès. Abstr. as follows from Presse méd., July 23, 1927, vol. 35, p. 924, in Jour. Am. Med. Assn., Oct. 29, 1927, vol. 89, p. 1559.*

The lesion, diagnosed as an acanthoma, situated at the extremity and on the left side of the nose, measured about 10 mm. in diameter. After local anesthesia, Bordier undertook diathermic coagulation of the epithelioma. There was perfect cicatrization with excellent result.—K. R. D.

SPLINTER OF IRON ON THE RETINA. *J. Fejer. Am. Jour. Ophth., Sept., 1927, vol. 10, pp. 674–677.*

"A splinter of iron entered thru the cornea and iris and lodged on the retina in the lower temporal quadrant. It was moved by the Haab magnet, but not drawn forward. The eye remained quiet with V. 5/5 two months afterward."

STEEL IN THE VITREOUS. CASE REPORT WITH NOTES. *H. L. Underwood. Am. Jour. Ophth., Oct., 1927, vol. 10, pp. 745–746.*

The case reported is that of a lumber mill worker, aged 19, who, while using a chisel and mallet to cut a link in a steel chain, felt something strike the left eye. No marked discomfort followed and he did not stop work until the next day, when he was first seen

by the author. The fragment of steel (weighing 0.0008 gm.) was situated almost on the retina; it "was not drawn forward by the giant magnet in front of the cornea. Later iris scissors applied to the magnet and introduced thru a scleral incision and repeatedly snipped brought away the particle. The track thru the lens cleared and standard vision was regained."—B. A.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

PROCEEDINGS OF THE THIRTEENTH ANNUAL MEETING OF THE INTERNATIONAL ASSOCIATION OF INDUSTRIAL ACCIDENT BOARDS AND COMMISSIONS HELD AT HARTFORD, CONN., SEPTEMBER 14–17, 1926. *U. S. Bur. Labor Statistics, Bull. No. 432, Feb., 1927, pp. 243.*

SAFETY MEETINGS. *Safe Practices Pamphlet No. 77, Nat. Safety News, April, 1927, vol. 15, pp. 33–38.*

ENGINEERING—A FACTOR IN ACCIDENT PREVENTION. *Safe Practices Pamphlet No. 79, Nat. Safety News, Aug., 1927, vol. 16, pp. 37–40.*

SAFETY RULES—THEIR FORMULATION AND ENFORCEMENT. *Safe Practices Pamphlet No. 80, Nat. Safety News, Oct., 1927, vol. 16, pp. 76–80.*

SAFETY CODES FOR THE PREVENTION OF DUST EXPLOSIONS. *Safety Engin., June, 1927, vol. 53, p. 270.*

THE STATUS OF THE NATIONAL SAFETY CODES. *American Engineering Standards Committee, 29 West 39th St., New York City; Safety Engin., Nov., 1927, vol. 54, pp. 155–159; Dec., 1927, pp. 195–198.*

Condensed résumés of forty-four national safety codes are listed, twenty two of which have been completed under the rules of procedure of the American Engineering Standards Committee; the rest are in the course of development.—R. M. T.

YEAR BOOK. AMERICAN ENGINEERING STANDARDS COMMITTEE, 1927 (REVISED TO MAY 1, 1927). *American Engineering Standards Committee, 29 West 39th St., New York City, pp. 80.*

MINE RESCUE WORK—A SPECIALIZED ART. *D. J. Parker. Nat. Safety News, June, 1927, vol. 15, pp. 9–12.*

Mine rescue work has become a highly specialized art, its efficiency being greatly increased by the introduction of oxygen breathing apparatus, gas masks of the All-Service or Universal type, the self-rescuer, the carbon monoxide detector, flame safety lamps, and electric portable safety lamps.

The United States Bureau of Mines conducts a complete course of mine rescue training through the medium of its eleven rescue cars and ten safety stations, and offers in addition an advanced course of instruction for underground officials. Since its beginning, the Bureau has trained approximately 180,000 persons in first aid and in the use of oxygen breathing apparatus.

Success in mine rescue work depends upon selection of suitable apparatus,

skill in its use, judgment, courage, and a thorough knowledge of mining conditions and practices.—R. M. T.

AN ANALYSIS OF MACHINE TOOL ACCIDENTS. *G. V. Fuller. Nat. Safety News, July, 1927, vol. 16, pp. 19–21.*

The National Council on Compensation Insurance, an association of eighty-five insurance carriers, has made a detailed study of 1,200 accidents occurring from 1918 to 1923 in machine shops insured by its members throughout the country. An analysis of the serious injuries resulting from these accidents shows the relative dangers of operating the several types of machine tools.—R. M. T.

POWER PLANT ACCIDENTS. *Safety Engin., Aug., 1927, vol. 54, p. 48.*

Classes of accidents and losses as determined by the Insurance Department of the United States Chamber of Commerce are here briefly reviewed. Accidents in the use of high pressure, high speed, and high voltage machinery are discussed under the following heads: boiler, pressure vessel, engine and flywheel, steam turbine, and electrical machinery accidents.—R. M. T.

ACCIDENT PREVENTION AND PRODUCTION. *J. E. Hannum. Safety Engin., Sept., 1927, vol. 54, pp. 83–86.*

This is an abstract of the final report of the Committee on Safety and Production of the American Engineering Council presenting data obtained from 14,000 companies which, in 1925, employed two and a half million workers. Information is treated under sixteen industry classifications, as follows: cement; chemical; coal mining; coke; electric light and power; electric railways; gas; iron and steel; machine building and metal working; mineral mining; paper, pulp, and paper products; quarrying; steam railways; telephone and telegraph; textile; and woodworking. In addition, combined data are shown for about 120 product groups.

Five major items of statistical data were obtained: (1) number of employees per year, (2) number of man hours per year, (3) annual production, (4) number of lost time accidents per year, (5) number of days lost due to lost time accidents per year.—R. M. T.

PLANT SAFETY RECORDS AND THEIR USE. *A. S. Johnson. Safety Engin., Oct., 1927, vol. 54, pp. 125–129.*

The importance of safety records, the sources of information, and the tabulation, analysis, and use of the material collected are discussed in detailed outline form.—R. M. T.

FIRE PROTECTION FOR THE FACTORY. *W. H. Seward. Nat. Safety News, Sept., 1927, vol. 16, pp. 15–16.*

Methods of fighting fires in industrial establishments by the use of sprinklers, organized fire departments, and first aid fire equipment are discussed. Special mention is made of the fire hazard from spray painting with nitrocellulose lacquers.—R. M. T.

ARE THE BUILDING TRADES MORE HAZARDOUS THAN OTHER INDUSTRIES? *J. P. Meade. Nat. Safety News, Sept., 1927, vol. 16, pp. 27–28.*

This is a review of the progress in accident prevention in Massachusetts during the last few years, with special reference to the building trades.—R. M. T.

PREVENTING INDUSTRIAL EYE INJURIES. *Safety Engin., Nov., 1927, vol. 54, pp. 160–162.*

This is an abstract of a paper read at the annual meeting of the National Committee for the Prevention of Blindness, Oct. 14, 1927, by H. Guilbert, director of the bureau of safety of the Pullman Company. Mr. Guilbert states that protection of eyesight will never be attained until every industrial employee is required to wear goggles in eye hazard zones on penalty of dismissal. This rule is being enforced in every repair shop of the Pullman Company, with the result that only one eye has been lost in a period of five years. Statistics showing the cost of eye injuries from industrial causes in Pennsylvania and New York State during the past year are cited, and it is pointed out that industrial occupations are responsible for about 15 per cent. of our total blind population today.—R. M. T.

INDUSTRIAL SURGERY

TREATMENT OF ACUTE COMMINUTED FRACTURES ABOUT THE ELBOW JOINT: REPORT OF SIXTY CASES. *H. E. Conwell. South. Med. Jour., Aug., 1927, vol. 20, pp. 579–585.*

The treatment of sixty selected cases of acute comminuted fractures of the elbow joint is here described, as presented at the Orthopedic Clinic of the Employes' Hospital, Tennessee Coal, Iron and Railroad Company, Fairfield, Ala. Consideration is given only to those cases in which routine treatment by the Jones method was impossible. The age of the patients varied from 2 to 65 years; nineteen of the cases were due to industrial accidents. The average time of treatment in the hospital was thirty-two days. Diagrams of the author's abduction frame are given, with photographs showing it in actual use.

The conclusions are given as follows:

(1) The treatment of soft structure injuries is as important as the treatment of bone and joint injuries.

(2) Perfect anatomical position is not always essential for perfect functional results.

(3) Every case of this type should be considered as an emergency for hospitalization, and reduction under general anesthesia should be immediately accomplished if the condition of the patient warrants.

(4) Excellent results have been obtained in the severely traumatized elbows which were treated with right angle abduction frame, with patient in bed and traction applied with the lateral board splints and frequent daily attention to soft structures, with active and passive motion to arm and elbow.

—B. A.

EFFECT OF OCCUPATION ON FORMATION OF PELVIS. *M. Hirsch. Abstr. as follows from Zentralbl. f. Gynäk., June 4, 1927, vol. 51, p. 1420, in Jour. Am. Med. Assn., Oct. 1, 1927, vol. 89, p. 1189.*

The figures presented by Hirsch show the deleterious influence on the form of the female pelvis of certain kinds of work during late childhood and adolescence. Work requiring standing and excessive and disproportionate use of the pelvic and abdominal muscles is especially bad. The worst effects were seen in the mining and metal industries. Agricultural work appears to do the least harm, but even here contracted pelvis

and pathologic labors were half again as frequent as among women who did not do any physical work. The danger diminishes steadily with the age at which the girl starts work. The textile industry has been the special field of Hirsch's investigations and he gives details concerning the muscular demands of this work and its effect on the immature bony pelvis. He urges that factory work should be prohibited to young girls.—K. R. D.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

AN EXPERIMENTAL STUDY OF DIATHERMY. IV. EVIDENCE FOR THE PENETRATION OF HIGH FREQUENCY CURRENTS THROUGH THE LIVING BODY. *R. V. Christie and C. A. L. Binger. Jour. Exper. Med., Nov., 1927, vol. 46, pp. 715–734.*

Summary and conclusions are given as follows, Part I dealing with "Experiments on Non-Living Material" and Part II with "Experiments on the Living Body:"

The principles governing the passage of high frequency currents through various conductors have been discussed and exemplified in experiments done on both non-living and living bodies.

In Part I it was shown: (1) That the current takes the path of least electrical resistance rather than the shortest path; (2) that maximal heating occurs at the point of greatest concentration of the lines of current flow. In a homogeneous medium with parallel electrodes maximal heat production occurs in those portions of the medium adjoining the electrodes and the heat gradient is from without inward. Under these circumstances maximal heating never occurs at the center. In discussing the localization of heat not only the electrical resistance and current concentration, but also the cooling effect, must be considered.

In experiments on the dog's cadaver no evidence of the so called "skin effect" could be demonstrated. This is in contradistinction to the findings of Bettman and Crohn, but the discrepancy is explained on the basis of what we believe to be a technical error in their work. The finding of no "skin effect" is in agreement with the conclusions of Dowse and Iredell, based on both experimental and theoretical considerations.

In Part II three types of experiments were performed on the anesthetized dog. The conclusions to be derived from them are these: (1) The heat gradient of the body is reversed during diathermy and heating occurs from without inward; (2) deep heating during diathermy is greater than that which results from the application of local heat to the skin; (3) the lung can be heated by diathermy in spite of simultaneous cooling of the chest wall.

These experiments we regard as satisfactory evidence of the passage of the current through the interior of the body.

INDUSTRIAL HYGIENE; VALUE OF FATIGUE PREVENTION. *F. Bordas and J. Courtier. Abstr. as follows from Ann. d'hyg. pub., indust. et sociale, 1927, vol. 5, pp. 327–338, in Bull. Hyg., Nov., 1927, vol. 2, p. 882.*

This article accepts as an axiom that the optima for health and output coincide. Hence avoidance of overfatigue is a matter of great social importance which can only be attained through knowledge of the physiology of fatigue. Right use of labor saving devices and rest pauses calls for study; the apprentice requires to be guided to suitable work and taught how to economize his energies; the adult needs help and rehabilitation when injured.

Accident prevention is connected with personal reaction to environment quite as much as with environment. Finally, after covering much familiar ground regarding the value to industry of studying human activity and health, the authors ask for the establishment of a national office in France, which, in addition to carrying out scientific investigations into industrial fatigue, might be intrusted with considering and presenting impartial evidence on arbitrations between masters and men. It should also possess facilities for: (1) studying the specific capacities of adolescents; (2) estimating invalidity; and (3) rehabilitating those injured at work. [British experience suggests that the scientific work would be strangled if associated with industrial disputes in the way here proposed.]

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

RESPIRATION IN INCREASED AIR PRESSURE. *A. Anthony. Beitr. z. Klin. d. Tuberk., May 21, 1927, vol. 66, p. 340.*

CAISSON DISEASE DURING HELMET DIVING: CASE. *W. M. Anderson. U. S. Nav. Med. Bull., July, 1927, vol. 25, p. 628.*

RESUSCITATION AFTER ELECTRICAL SHOCK. *W. Maclachlan. Canadian Med. Assn. Jour., 1927, vol. 17, pp. 1346–1350.*

The effects of electric current on the body are summed up as follows:

1. The effect of the shock is greatly increased if the points of contact between the body and the electrical conductors are good, or, in other words, the effect will be greater if wet hands are placed on electrical conductors than if dry hands are placed, hence the fatal shocks in bathrooms from comparatively low voltage.

2. The path of the current through the body has a decided effect on the shock. If a shock be received from foot to foot, the effect will be immeasurably less than if received from head to foot, hand to foot or head to hand. Where the path of the current lies through the medulla or thorax the effect (other things being equal) will be greatest.

3. The amperage of the current passing through the body has a distinct effect on the shock. Hence, with the same condition of points of contact and duration of contact, the effects from higher voltages are greater.

4. The duration of the contact has an effect on the shock, as it is shown that the heart does not beat during the period of contact.

5. The passage of the current through the body may have a permanent effect on the heart. There may be a temporary inhibition, or damage of the heart muscle, or ventricular fibrillation may be set up. The exact nature of these effects is not known and research is needed to clear up the problem.

6. The passage of the current causes a profound paresis or inhibition of the respiratory function. This inhibition is at or near the respiratory centre and may not be permanent. As to the exact nature of the lesion little, if anything, is known.

7. The passage of the current causes an inhibition of the vaso-motor system, particularly the vasoconstrictors. The nature of this inhibition or block is not known.

8. From the time of the passage of the current until the return of the eye reflex, the brain is insensitive to extraneous influences, such as stimulation of the central end of the cut vagus or cut sciatic. Hence, many of the usual tests for life fail.

Although the patient may be unconscious and not breathing, although

the pulse cannot be felt nor the heart beat heard, resuscitation by the prone pressure method may prove successful. The author describes, with illustrations, the prone pressure method of resuscitation. He points out the importance of continuing resuscitation until natural breathing begins or rigor mortis sets in, and outlines the procedure to be followed from the time of the accident to the patient's arrival at the hospital.—M. G. P.

ELECTRICAL BURNS AND ELECTRICAL SHOCK. *R. E. Gaby. Canadian Med. Assn. Jour., 1927, vol. 17, pp. 1343–1345.*

The severity of the electric accident depends upon (1) the type of current, (2) the voltage, (3) duration of contact, (4) point of contact and path of current, (5) condition of contact, (6) concentration of current, (7) character of grounding, and (8) personal toleration.

In about 90 per cent. of the accidents, the main injuries are from burns rather than from shock. The electric burn causes "definite vascular changes, consisting of a disintegration of the media, the lumen remaining intact and the blood in the neighbourhood remaining fluid. This weakening of the vessel wall results in often serious haemorrhages, and may occur at some distance from the site of the apparent burn. . . . . There is also a tendency to peripheral thrombosis, angiospasm, and oedema. . . . . .

"There are no gross lesions within the body absolutely indicative of death by electrical shock. Petechial haemorrhages in the brain stem and fragmentation of the heart muscle have been described as pathognomonic. There is frequently an anuria, and red blood cells are usually present for the first few days in any urine passed. Leucocytosis is present. There is a blood concentration which may be an important factor in subsequent death, as it is in ordinary burns. The complications are the same as in the case of ordinary burns. The toxaemia, however, is apparently not so severe. The resulting deformities and contractural and cicatricial disability are often very great."

Death from electric shock has usually been attributed to (1) ventricular fibrillation or (2) paralysis of the respiratory center, recent observations tending to show that deaths are more often due to paralysis of the respiratory and vasomotor centers. Artificial respiration should be applied immediately in all cases of electric shock and continued until normal breathing is resumed or death occurs. —M. G. P.

A PAROXYSM OF AURICULAR FIBRILLATION CAUSED BY ELECTRIC SHOCK. *E. E. Laslett. Brit. Med. Jour., May 21, 1927, vol. 1, p. 919.*

The case reported is of a man, aged 35, who, while working in a tunnel, took hold of a large portable electric lamp which was temporarily connected with the switch of a motor. He immediately received a shock and was unable to release his hold of the lamp. When the current was cut off by a fellow workman, the man did not apparently lose consciousness, but felt dazed and had a strange fluttering sensation in his chest. After a rest he resumed his work for the remainder of the afternoon and that evening consulted Dr. Laslett, who found quick

and irregular pulse. The next morning the pulse was regular and no abnormalities could be detected. The victim had never had rheumatism and apart from partial deafness due to nasal obstruction he was in good health.—B. A.

UNILATERAL SPINAL PARALYSIS FROM ELECTRICAL INJURY. *K. Mendel. Deutsch. med. Wchnschr., Sept. 23, 1927, vol. 53, pp. 1642–1643.*

Mendel reports the case of an electric engine fitter, 59 years of age, in good health, who received a severe shock through his left arm from a 500-volt alternating current. He was unconscious for only a moment. The skin on the back of his left hand was slightly burned. The accident caused atrophic (certainly spinal) paralysis of the left arm and leg with complete reaction of degeneration in several muscles, markedly irregular heart action, and strangury. It seems as if the current went through the left arm to the heart and spinal column, in the left side of the cord descended to the anterior cornua, exercising its destructive action there only, then leaving the body through the left leg.—M. C. S.

ELECTRICAL HAZARDS AROUND THE PLANT. *R. S. Shoemaker. Nat. Safety News, July, 1927, vol. 16, pp. 9–10.*

The author recommends as safety measures the permanent grounding of all current carrying parts of stationary electrical equipment; systematic maintenance of portable electrically driven hand tools, testing and controlling devices to prevent accidental grounding of frames or other parts; provision of best all-rubber cables, nonmetallic plugs, sockets, and lamp guards for portable lights; enforcement of the rule that no repairs are to be permitted while current is on; careful and frequent inspection of the underground system in conduits and manholes and the prohibition of open lights in order to prevent gas explosions.—R. M. T.

HEAT, COLD, AND HUMIDITY

STUDY OF THE FIRER AT THE STATE PORCELAIN FACTORY "DULEWO." *A. Atabekian. Gigiena Truda, 1926, no. 3, pp. 44–54.*

The influence on the organism of the high temperature experienced in taking fired products out of the furnace was studied. The temperature of the furnace was measured during work at a man's height and under the crown to which the worker must raise himself in order to reach the chamotte sagger with his ware. The body temperature of the worker, in sitting position, was taken immediately after he left the furnace. The loss from perspiration and evaporation was determined by weighing the man before work and one-half hour after. The results showed a constant increase in temperature (measured at the armpit), loss in weight, and acceleration of the pulse rate. The subjective sensations of the workers are varied; some com-

plain of palpitation, dizziness, and things becoming dark before their eyes, whereas others are indifferent.

In order to discover just how injurious to health are the overheating of the body and overstrain of the heart occasioned by working at the hot furnace, it would be necessary to make observations over a longer period and in a cabinet especially arranged in immediate proximity to the furnace. —M. G. P.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

THE YEAR'S PROGRESS IN ILLUMINATION, 1926–1927. 1927 REPORT OF THE COMMITTEE ON PROGRESS. *Tr. Illumin. Engin. Soc., Sept., 1927, vol. 22, pp. 689–824.*

This is a report of 136 pages on the year's progress in illumination, under the following heads: gas, incandescent lamps, arc lamps, lamps for projection purposes, street lighting, other exterior illumination, interior illumination, luminaires, photometry, physics, physiology, illuminating engineering. The report contains 641 citations and concludes with a list of twelve recommended books.—P. D.

THE MEASUREMENT OF ATMOSPHERIC POLLUTION, VISIBLE AND INVISIBLE. *G. T. Moore. Jour. Am. Soc. Heating and Ventil. Eng., Oct., 1927, vol. 33, pp. 595–598.*

This is a brief description of the Owens Automatic Air Filter, of the Owens Jet Dust Counter, of the Owens method of measuring the acidity of the air, of the measurement of sulphur dioxide, and of the detection of air borne pathogenic organisms.—P. D.

THE EFFECT OF ATMOSPHERIC SMOKE POLLUTION. A SUMMARY OF OPINIONS FROM CURRENT LITERATURE. *A. S. Langsdorf. Abstract of paper read at First National Meeting of Am. Soc. Mech. Eng. Fuels Division, St. Louis, Mo., Oct. 10 to 13, 1927, pp. 7 (mimeographed); Mech. Engin., 1927, vol. 49, pp. 1213–1215.*

This is a review treating particularly of the (*a*) medical, (*b*) botanical, and (*c*) physical effects of atmospheric smoke, and touching upon (*d*) the economic aspects of the smoke pollution problem.—P. D.

CLEVELAND SMOKE-ABATEMENT METHODS. *E. H. Whitlock. Jour. Am. Soc. Heating and Ventil. Eng., Oct., 1927, vol. 33, pp. 599–606.*

This is a general discussion, with persistence of effort under competent organization as the keynote to success. —P. D.

ORGANIZING A SMOKE-ABATEMENT CAMPAIGN. *E. Ormsby. Mech. Engin., Oct., 1927, vol. 49.*

"A smoke-abatement campaign in a large city will be successful just in proportion as team work and coöperation may be secured between all classes, businesses, organizations, individuals, etc."

The author discusses in practical terms the organization and conduct of a smoke abatement campaign, stressing throughout the fact that

excessive smokiness is costly and unnecessary. It is estimated that excessive smokiness in an American city costs about $15 to $20 per capita per annum, whereas the yearly cost to the entire United States is placed at about $500,000,000.—P. D.

A Smoke-Density Meter. *F. Sawford. Abstr. as follows from Mech. Engin., 1927, vol. 49, pp. 999–1004, in Chem. Abstr., Oct. 20, 1927, vol. 21, p. 3444.*

A discussion of the desirability of having measuring instruments in the boiler room is followed by a description of a meter to measure smoke density. The manner in which this will aid in smoke abatement and in improving furnace efficiencies is pointed out. The instrument makes use of a photo-electric cell and an amplifying vacuum tube with an indicating and recording instrument to measure actual smoke density. The instrument proper consists of an indicator or recorder or both mounted on or near the boiler front, or at any other convenient location. Within the instrument is contained the current amplifying apparatus forming a complete self-contained unit. The second part, or optical system, is placed in the smoke flue or chimney, preferably where the flue temperature is not excessive. Details of the instrument are described and illustrated. Used in conjunction with carbon dioxide recorders, the smoke density meter should not only aid in smoke abatement, but also in improving the boiler efficiency.—P. D.

Industry and Smoke Abatement. *M. A. C. Brereton and I. M. Horobin. Jour. State Med., May, 1927, vol. 35, p. 293.*

Ventilation of Dye Vats in Dye Works. *M. Pokrowsky. Gigiena Truda, 1926, no. 3, pp. 82–85.*

Fumes containing dangerous gases rise in large amounts from the dye vats in dye works, producing excessive humidity in the air of the workroom and polluting it with noxious gases.

Professor A. Seliwerstow recently made an investigation of the atmosphere in the dye works of the Moscow Trechgornij-Krasnopresnensky textile factory. Two arrangements for local exhaust ventilation were used (illustrations being given in the article); good results were secured by drawing air through the side openings at a velocity of 0.25 meter per second. An inspection of the plant showed that the high temperature and the moisture content of the air were considerably reduced.

Professor Seliwerstow is of the opinion that ventilating hoods can be provided for at least 90 per cent. of all dye vats, a conclusion which considerably facilitates the solution of the ventilation problem in dye works.—M. G. P.

Removing Air Contamination at Source. *W. J. Graves. Nat. Safety News, June, 1927, vol. 15, pp. 19–21.*

The author makes a plea for the more general use of properly designed mechanical systems for the removal of air contamination at its source. A comparatively new application of this method of intensive mechanical ventilation is the unit suction system, of which the familiar spray booth is a good example. The unit system is advantageous because suctional effi-

ciency is greater than with the group system, the cost of piping is eliminated, and the absence of mains and piping improves lighting and facilitates handling of material on overhead conveyors. The substitution of the suction box for the old pyramid type of hood on pickling baths and the like is a further indication of progress.

It is regrettable that the author refers to the use of ozone generators as a means of rendering employees in garages immune to the poisonous effect of carbon monoxide gas, a fallacy which has been fully dealt with by C. M. Salls in THIS JOURNAL (1927, vol. 9, p. 503).—R. M. T.

CHANGING CONCEPTIONS OF VENTILATION SINCE THE 18TH CENTURY. *G. T. Palmer. Jour. Am. Soc. Heating and Ventil. Eng., Oct., 1927, vol. 33, pp. 613–619.*

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

THE RAILWAY SANITARY SERVICE IN ITALY. *Italy Letter, Jour. Am. Med. Assn., Oct. 15, 1927, vol. 89, pp. 1349–1350.*

The government railway sanitary service in Italy is administered by two distinct groups of physicians. One group, about fifty in number, is composed of full time officials; a second group, much more numerous (about 2,000), is constituted by physicians who devote to the railway administration only a part of their professional activity. To the latter group belong the division physicians, the consultants, and the specialists. The division physicians perform fiscal duties in connection with the diagnosis of diseases occurring in the personnel of the railways, and serve, on occasion, as attending physicians. In addition, they perform vaccinations, look after antimalaria prophylaxis, and maintain the efficiency of the sanitary equipment at the railway stations and at other posts along the railway lines. The consultants and specialists assist, on request, the division physicians on the more important visits and in the solution of medicolegal problems. The physicians of the second group are compensated chiefly by free transportation on the railways, but they receive also some cash emoluments.

The full time medical officers devote themselves chiefly to the examination of applicants for employment and to the reexamination of the personnel, to the organization of first aid services, to the collection of sanitary statistics, and to the supervision of the work of the division physicians. A central sanitary bureau, with headquarters in Rome, directs and controls the services of all the sanitary officials attached to the railways, and keeps a close contact, in matters pertaining to the health of travelers, with the public health service and the military health service. —K. R. D.

INVESTIGATIONS IN FIRST-AID ORGANIZATION AT COLLIERIES IN GREAT BRITAIN. *A. J. Cronin. Mines Department. H. M. Stationery Office, 1927, pp. 41.*

This report is the result of an extensive investigation made at a number of collieries spread over all the coal fields in Great Britain. With commendable reticence criticism is withheld; but the comment is tersely made that the first aid organization found at 500 collieries was unsatisfactory in 57 per cent. Yet it is worth while; since twenty collieries with efficient first aid were found paying 3.1d a ton in average compensation payments, compared with an average of 6.7d a ton for twenty collieries with inefficient organization. One colliery, by organizing its first aid, in two years lowered its payments from 8d to 4d a ton, effecting a saving by which a sum of £400 spent on inaugurating the system was swallowed up. Expenditure on the highest scale seen only amounted to 9.6d a man; but a sum of £40 per annum should be ample for 1,000 men.

Dr. Cronin then points out that without an enthusiastic manager the first aid system is never good. The interest of the men must be awakened and a certain number must be carefully trained in first aid methods for which purpose co-operation with such first aid organizations as that of St. John and of St. Andrew is advantageous. Nevertheless a skilled personnel is useless without efficient provision. What this should be with regard to site, construction, size, lighting, heating, water supply, and fittings, is clearly set forth. Dr. Cronin advocates a first aid room at the pithead conveniently placed for access as the miners come off work. Organized from this center he would have each deputy trained as a first aid man and provided with a small first aid box for use in the workings. Each day the box would be left at the first aid station where it would be recharged before next day, just as electric safety lamps are recharged. The writer goes into details on type and amount of equipment required by collieries of various sizes. The use of sterilized dressings is strongly advocated and the disuse of such time honored atrocities as carron oil. One section is devoted to the question of transport (1) above ground, for which purpose the use is advocated of an organized service of well-equipped ambulance cars such as exists on the South Wales coal field; and (2) underground, which presents special difficulties—an admirable ambulance trolley is shown in illustration.

Many other valuable hints are given in this report which concludes by stating the opinion that the regulations now in force are faulty and require to be brought up to date so that the standard of first aid organization in collieries can be brought in line with what today is found in other industries following upon the coming into force of the Workmen's Compensation Act, 1924.—E. L. C.

WOUND INFECTION AND FIRST AID FOR SMALLER INDUSTRIAL PLANTS. *M. J. Shields. Safety Engin., Sept., 1927, vol. 54, pp. 102–104.*

This gives a short description of first aid procedures for smaller industrial plants which do not employ a nurse or physician, with a preliminary discussion of wound infection.—R. M. T.

THE HIGH COST OF INFECTION IN RELATION TO INDUSTRIAL INJURIES. *A. C. Carruthers. Safety Engin., Nov., 1927, vol. 54, pp. 180–182.*

More than 10 per cent. of all compensable accidents in New York, Ohio, and Massachusetts show a history of infection of the injured parts. Financial and time losses for infected, as compared with non-infected, injuries are given.—R. M. T.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

Scheme of Factory Canteen for 250 Workers. *Home Office. H. M. Stationery Office, 1927.*

This publication is a short, but useful, pamphlet in the welfare series of the British Factory Department. It gives hints as to organization and staff needed, and as to plant and equipment; but its best part consists of two scale plans, one showing arrangement of the building and the other details of kitchen and service.—E. L. C.

The Institution of a Permanent International Welfare Committee in Paris for Seamen. *V. O. Bogusat. Abstr. from Reichs-Gsndhtsbl., 1927, vol. 2, pp. 428–429, in Bull Hyg., Nov., 1927, vol. 2, p. 890.*

In 1926 on the suggestion of the Norwegian Red Cross Society an International Conference was held in Norway to consider the question of improving the hygienic conditions of seamen and the medical arrangements provided for them and a permanent committee was appointed.

The Committee met for the first time last February in Paris, and considered particularly the schedule of medical equipment for ships of all nations sailing without a doctor; medical consultations by wireless; and the drawing up of a handbook.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

Decisions of Courts and Opinions Affecting Labor, 1926. *U. S. Bur. Labor Statistics, Bull. No. 444, June, 1927, pp. 312.*

Labor Laws as a Means of Preventing Diseases of Occupation. *J. Roach. Safety Engin., July, 1927, vol. 54, pp. 30–32; U. S. Month. Labor Rev., Aug., 1927, vol. 25, pp. 281–283.*

In the author's opinion, the preventive effects resulting from the passage of workmen's compensation and occupational disease laws are incomparably more important than the compensation itself; they are indicative of the new emphasis placed upon industrial health problems and of the increasing knowledge of the cause and treatment of industrial disease. Eighty-one cases receiving compensation in New Jersey during the past year are tabulated, the most frequent diseases being lead and benzol poisoning, anthrax, and diseases of occupational activity (cellulitis, etc.). —R. M. T.

New York Labor Laws Enacted in 1927 and Federal "Longshoremen's and Harbor Workers' Compensation Act" of March 4, 1927. *N. Y. State Dept. Labor, Special Bull. No. 151, 1927, pp. 70.*

LONGSHOREMEN AND HARBOR WORKERS' COMPENSATION ACT. *A. S. Regula. Safety Engin., July, 1927, vol. 54, pp. 15–18.*

This is a summary of the terms of this Act, which became effective July 1, 1927.

CAUSES OF COMPENSATED ACCIDENTS—TWO YEARS ENDED JUNE 30, 1926. *N. Y. State Dept. Labor, Special Bull. No. 152, 1927, pp. 145.*

This statistical analysis of causes of compensated accidents supplements Special Bulletins 146 and 148 in which were presented data concerning compensation for the same period.

ACCIDENT NEUROSES. *W. Kaldewey. Klin. Wchnschr., July 30, 1927, vol. 6, p. 1475.*

SOCIAL AND INDUSTRIAL HYGIENE. *A. Seitz. Klin. Wchnschr., Aug. 13, 1927, vol. 6, p. 1571.*

REVIEW OF SOCIAL INSURANCE IN GERMANY. *G. Wolff. Abstr. from Zentralbl. f. Gewerbehyg., Feb., 1927, N. S. vol. 4, pp. 49–53, in Bull. Hyg., Oct., 1927, vol. 2, p. 844.*

Reviews the results of the German Social Insurance Acts for the year 1924 to 1925.

Sickness insurance is compulsory on all workers and included about 19,000,000 persons. Experience shows that in industry every second workman, and in agriculture every third, is sick once a year and each case of sickness lasts on the average twenty days. The payments by the members of the Industrial Sickness Societies (*Betriebskrankenkassen*) is 40 per cent. higher than that of the District Societies (*Ortskrankenkassen*) and three times as high as that of the Rural Societies (*Landkrankenkassen*). This is attributed to the greater sickness risk and lessened power of resistance of the industrial worker. Increased illness due to slackness of trade and unemployment is emphasized. From Jan. 1, 1926, eleven industrial diseases have been brought under this Act for compensation as accidents.

Miners' insurance again comes under a separate Act as the others were not sufficient to cover the risks. From Jan. 1, 1924, a further Miners' Insurance Act came into force, giving specially favorable terms to miners for invalidity after twenty-five years of work.

REHABILITATION OF DISABLED EMPLOYEES

EMPLOYMENT OF THE HANDICAPPED. *H. J. Mellum. Occup. Therapy, Oct., 1926, vol. 5, pp. 335–342.*

The co-operation of all agencies with their respective communities and with the state board of vocational education is urged, so that persons injured at work may be taken back into industry as early as possible and placed at work suitable for them. The experience of several large plants is briefly reviewed, citing instances of successful rehabilitation of cases of severe injury, and the plea is made that all factories, small or large, should be alike expected to give a fair deal in the matter of reemployment of those injured at work.—B. A.

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

THE HEALTH OF THE WORKER. *J. Mackenzie. Address to Annual Conference of Nat. Assn. of Insurance Committees, Oct., 1927.*

Some account is given of the progress of the Industrial Health Education Society since its start three years ago in Scotland. It has already spread to England and Wales and its activities are only limited by finance. Its objects are to provide lectures and information to workers on occupational diseases and health. Most trades and industries have ailments peculiar to them, concerning which workers desire information. The list of subjects covered is varied and extensive and the demand for lectures is ever increasing. Trade and labor councils, as well as employers, are in favor of the movement, which may help to lessen the immense total of lost time in industry amounting in 1924 to 26,000,000 weeks' work. It should also appeal to insurance committees.—E. L. C.

THE HUMAN FACTOR IN INDUSTRY. *Pottevin. Bull. de l'Acad. de méd., Paris, 1927, vol. 98, pp. 345–348.*

The author in this lecture stresses the importance of studying the human factor in industry. First there is need to mate the worker and his work, according to physical and psychologic characteristics; in this way the schoolchild should be shepherded into his life's work. Then comes teaching how to work so as to avoid unnecessary expenditure of energy. Rhythm in movement must be taught and rest pauses properly interpolated. Ventilation and lighting call for research both in laboratory and factory. Advance in these matters spells national economy.—E. L. C.

FACTORY INSPECTION IN JAPAN IN 1925. *Internat. Labour Rev., Oct., 1927, vol. 16, pp. 540–544.*

Inspection was still carried out under the old Factory Act which applied to 27,076 factories employing about one and a half million persons. Hours of work remain long, twelve per day in silk spinning and ten in cotton weaving and spinning; but they tend to decrease and the eight-hour day prevails in engineering; even though two twelve-hour shifts are to be found in chemical factories. Two rest days a month are statutory and in some cases all four Sundays are observed. Considerable advance is reported in the study of accident prevention, industrial efficiency, and the environment of labor. But the need for regulations for dormitories attached to factories seems strange and reminiscent of the early nineteenth century in England when the children slept at the mills.—E. L. C.

THE POPULATION PROBLEM AND INDUSTRIALISATION IN JAPAN. *I. F. Ayusawa. Internat. Labour Rev., Oct., 1927, vol. 16, pp. 512–526.*

Some account is given of the increase in the Japanese nation which has followed upon industrialization in Japan where the population has doubled in the last fifty years and amounts now to sixty million. How industry has exerted so profound an influence is not clear since even in 1925 there were employed in factories coming under the Japanese Factory Act only one and a half million persons of whom textiles claimed nearly one million. The position of Japan today with a high death rate (20 per thousand) and a high birth rate (34.7 per thousand) closely resembles that of Great Britain fifty years ago. There are other similarities in her stage of industrial development. The author pays most attention to the food question, as Japan is yearly being compelled to import more and more rice. A plan of national fertilization of homelands has been advanced to check this adverse economy. Migration is discussed as a remedy, but in fact the Japanese are not naturally emigrants and the total resident abroad has never exceeded 300,000—the result of some sixty years of effort at emigration. The article is one of considerable social interest.—E. L. C.

HYGIENE IN INDUSTRY. *I. Salmon. Jour. Roy. San. Inst., Dec., 1927, vol. 48, pp. 301–307.*

This address from a director of a vast food factory is of interest. The subject is divided into hygiene of (*a*) the worker, and (*b*) the factory. Personal hygiene needs not only modern

clinics, medical officers, dentists, manicure and pedicure sections, massage and electrical treatment rooms, but also home sick visiting and schemes of rehabilitation. More, however, is said on factory hygiene as it applies to plant and machinery, for which a separate staff is to be employed. Foodstuffs must be hygienically manipulated from raw material to storage. Ice cream, for instance, must be pasteurized before being rapidly frozen; meat must be sterilized without being damaged. Cleanliness alone is no longer sufficient; the bacteriologic content of the air must be watched; the indiscriminate use of disinfectants is to be condemned. Hygienic conditions mean healthy workers and a good product. For this reason legislation should not interfere when economic advantage will work better results. Hygiene in industry is a science impeded rather than stimulated by Acts. Its practice must, by diminishing industrial unrest, create prosperity.—E. L. C.

An Industrial Museum. *Lancet, Dec. 10, 1927, vol. 2, 1251–1252.*

A museum constructed by the Home Office has just been opened in London for displaying appliances devised for promoting safety, health, and welfare in industries. The building was nearly ready on the outbreak of war, thirteen years ago; then it was given up for other uses, and only now reverts to its original purpose. In the safety section ingenious devices are shown for guarding machinery or throwing it out of action if not worked in a proper manner or in such a way as to cause danger; the fertility displayed by inventors is surprising. A section is devoted to displays relating to such industrial diseases as lead poisoning, silicosis, dermatitis, and skin cancer; and charts appear illustrating the incidence of the diseases in various industries with models of the lesions caused. Anthrax in particular is the subject of an interesting exhibit prepared by the anthrax disinfecting station at Liverpool. Methods of illumination and efficient ventilation are demonstrated as are also rest rooms, canteens, first aid appliances and ambulances. The museum is up to date and should serve a useful purpose by keeping welfare workers and employers in touch with modern advances in industrial health.—E. L. C.

Health of Miners. *T. L. Llewellyn. Iron and Coal Trades Rev., Dec., 1927.*

A review is given of a number of investigations made from different viewpoints into the health of coal miners. Vital statistics for this occupation have always been satisfactory, except for accident mortality. Bronchitis and emphysema have been greatly improved by modern ventilation. Certain compensated diseases which, however, cause no mortality, are peculiar to coal mining, *viz.:* nystagmus, and cellulitis of the knee, hand, and elbow. Nystagmus, with oscillation of the eyeballs, is an occupational neurosis, due to deficient illumination underground—but this causation is disputed by some; it is the most important of all compensated diseases and costs about £1,000,000 annually. The neurotic element, once a claim is established, makes the disease difficult of cure. The cases of cellulitis are due to localized infections

of parts previously injured by continued trauma; cleanliness of the skin and care at work should prevent most cases. Recently the occurrence of silicosis, although not extensive in prevalence, has been recognized among miners driving roads and sinking shafts through hard and dry sandstone rocks; such silicosis may account for the late age of maximum incidence of the low mortality attributed to tuberculosis. As mines go deeper, more and more trouble is being experienced from moist heat which demands greater attention from engineers in providing adequate ventilation. Such infectious diseases as ankylostomiasis and spirochaetosis icterohaemorrhagica have been known to occur among British miners; they are rare and avoidable.

Rehabilitation after injury is of great importance in the case of miners for whom cure without restoration of function means loss of occupation; skilled surgery and physiotherapy are needed. Medical examination before engagement and instruction in mining methods would raise the standard of miners. Much remains to be done, by attention to the human factor, to help the coal industry economically and to make it fit for the men who work therein.—E. L. C.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

Chronic Benzol Poisoning. *F. T. Hunter and S. S. Hanflig. Abstr. as follows from Boston Med. and Surg. Jour., Aug. 25, 1927, vol. 197, p. 292, in Jour. Am. Med. Assn., Oct. 29, 1927, vol. 89, p. 1548.*

Of the four cases reported by Hunter and Hanflig, the two fatal ones both presented septic temperatures; the two patients who recovered did not. In the fatal cases the white count fell within a short time to below 1,000 and remained low in spite of transfusion. On the other hand, in the patients who recovered, the white count at no time fell below 1,000 and showed more of a tendency to increase after one or two transfusions. In none of these cases was the spleen palpable. This is an important point in differentiating chronic benzene poisoning from idiopathic purpura hemorrhagica and from the so-called aleukemic leukemias. Aside from transfusions, the treatment should be directed toward cleanliness of the mouth in particular and the prevention of intercurrent infection in general. The ultraviolet lamp might be used in small doses to improve the general resistance. The only effective treatment, however, is prevention of poisoning by adequate supervision of industries using benzene.—K. R. D.

Chronic Benzol Poisoning among Women Industrial Workers. *N. Y. State Dept. Labor, Special Bull. No. 150, 1927, pp. 64.*

For abstract of this study of the women exposed to benzol fumes in six factories, see article by Dr. Adelaide Ross Smith in This Journal (1928, vol. 10, p. 73).

Simultaneous Determination of the Blood Sugar Content, and the Gas Content and Alkalinity of the

ARTERIAL BLOOD DURING CARBON MONOXIDE POISONING. *S. Mikami. Abstr. as follows from Tohoku Jour. Exper. Med., 1927, vol. 8, pp. 237–277, in Ber. ü. d. ges. Physiol. u. exper. Pharmakol., Aug. 31, 1927, vol. 41, p. 87.*

In rabbits which were poisoned with carbon monoxide, the gas content (carbon dioxide, oxygen, carbon monoxide) of the arterial blood and the blood sugar were determined simultaneously. After subcutaneous injection of carbon monoxide the oxygen content as well as the carbon dioxide content fell; the minimum oxygen content was found one to two hours after the injection, the minimum carbon dioxide content one hour later, parallel with which there was an increase in the blood sugar. In poisoning by inhalation of carbon monoxide, the decrease in oxygen and the increase in blood sugar ran parallel both temporally and quantitatively, as did the return to the initial figure. In animals whose vagus nerve had been cut, the poisoning ran a similar course; the same rapidity of respiration occurred as in the intact animals but the recovery (the rise in oxygen) was slower. In all cases the hydrogen ion concentration of the blood was lowered, but not for so long a time as was the oxygen content. Fatal carbon monoxide poisoning caused an increasing drop in oxygen, carbon dioxide, and hydrogen ion concentration until death resulted. Injection of alkalies prevented damage from carbon monoxide and the increase in blood sugar to a certain extent.—M. C. S.

CARBON MONOXIDE IN TWO LARGE GARAGES. *S. H. Katz and H. W. Frevert. Indust. and Engin. Chem., Jan., 1928, vol. 20, pp. 31–36.*

This paper is summarized as follows:

Carbon monoxide was determined continuously in the Government Fuel-Yard Garage, Washington, D. C., during nearly three weeks of January, 1927, and in a large commercial garage in Pittsburgh, Pa., through the greater part of the four succeeding months. A carbon monoxide recorder was used, the records indicating carbon monoxide in parts per 10,000 and fractions thereof. Maximum and average concentrations of carbon monoxide for each of three periods per day and for one hour in each day showing maximum average carbon monoxide were compiled. The maximum indication exceeded 8.9 p.p.t.t., the upper limit of the recorder, on a few occasions, but only momentarily. The average concentration through the hours 7:20 A.M. to 4:30 P.M. at the Government Fuel-Yard Garage in no case exceeded 1 p.p.t.t. The highest average at the commercial garage for the hours 6:00 A.M. to 6:00 P.M. was 1.64 p.p.t.t. The highest average for any one hour was 4.33 p.p.t.t. at the commercial garage; this may cause headache in some persons. The carbon monoxide was not found very injurious, but no very cold weather occurred during the period of the records. In very cold weather when garages are kept more tightly closed to retain heat, worse conditions may occur if operations are otherwise the same.

—P. D.

SELENIUM SULFIDE—A NEW DETECTOR FOR MERCURY VAPOR. *B. W. Nordlander. Indust. and Engin. Chem., April, 1927, vol. 19, pp. 518–521.*

This method is based on the reaction between active selenium sulphide and mercury vapor. The selenium sulphide is applied as a coating to paper and the coated paper is blackened on exposure to the air containing mercury

vapor, the degree of blackening being a function of time of exposure, concentration of the mercury, and other factors, which can be definitely controlled. Apparatus has been developed by means of which it is possible to measure concentrations over a rather wide range.

The sensitivity of the method is extremely high and varies from 1 part per 8,000,000 to 1 part per 15,000. These ranges can be increased still further by varying the lengths of exposure of the test paper.

Of particular interest to industrial hygienists is the fact that the apparatus can be made up in portable form and adapted into a recording device with comparative ease. The author states that, by using a photo-electric cell circuit, the degree of blackening—*i.e.*, the concentration of mercury—can be expressed in milliamperes.

It is probable that the other heavy metals will produce similar reactions with selenium sulphide, but, on account of their low vapor tensions at normal temperatures (70°F.), it is improbable that they will interfere with mercury detection.

In view of the increased use of mercury in various chemical and manufacturing processes and of the mercury boiler, a sensitive mechanical analyzer for minute amounts of mercury vapor in air is most welcome.—P. D.

A New Method for Detecting and Measuring Mercury Vapor. *B. W. Nordlander. Nat. Safety News, July, 1927, vol. 16, pp. 37–38.*

The Risk of Arsenic Poisoning as Seen in Certain Branches of the Chemical Industry. *F. H. de Balsac, E. Agasse-Lafont, and A. Feil. Presse méd., Sept. 10, 1927, vol. 35, pp. 1107–1109.*

A report is made on visits to factories where arsenate of soda and arsenic acid were made. Those employed were examined; but, contrary to expectation, general illness due to arsenical compounds was not traced, nor were clinical signs of poisoning detected. Some conjunctivitis due to dust of arsenate of soda, and also intestinal colic and diarrhea are reported. But the only real trouble was cutaneous. The skin becomes red and irritable; if the arsenate of soda falls on a cut or scratch it is painful, and an ulcer or acid hole may follow. Such lesions all heal on cessation of occupational exposure. Men manipulating arsenic acid were less affected.—E. L. C.

Poisoning from Chromium. *Foreign Letter (Japan), Jour. Am. Med. Assn., Dec. 10, 1927, vol. 89, p. 2055.*

It was recently found that workers in a certain factory are suffering from a disease of the nose caused by chromium. It is the first time this has been seen in Japanese medical circles.—K. R. D.

The Pharmacology of Lead: II. The Distribution and Chemical Composition of Very Small Quantities of Lead in the Blood. *B. Behrens and R. Pachur. Abstr. as follows from Arch. f. exper. Path. u. Pharmakol., 1927, vol. 122, in München. med. Wchnschr., Sept. 9, 1927, vol. 74, p. 1561.*

In lead poisoning the lead is in the blood serum chiefly in the form of a

nondialyzable compound; a small part only is in dialyzable form as lead ion. If blood be mixed with a small quantity of a lead salt, what is apparently a colloidal lead compound forms and is adsorbed on the surface of the erythrocyte while the ionized portion of the lead forms a reversible chemical combination with the substance of the erythrocyte, although the latter has little significance because of the small quantity of ionized lead in the blood. The combination of lead with erythrocytes occurs more rapidly in venous blood than in arterial.—A. H.

Early Diagnosis of Lead Poisoning. *K. Kjer. Abstr. as follows from Bibliot. f. Laeger, Jan., 1927, vol. 119, p. 21, in Jour. Am. Med. Assn., Nov. 26, 1927, vol. 89, p. 1916.*

Sixty-one workmen handling lead were examined by Kjer every two weeks from October, 1924, to June, 1925. He says that observation at least twice monthly is necessary in this occupation. He rejects tests for hematoporphyrinuria in ambulant practice, but finds the test an excellent indication with a twenty-four hour specimen of urine. Basophilia is a useful early sign, which, used quantitatively, also shows the degree of intoxication. More than 1,000 granulated erythrocytes per million indicates danger of intoxication. Subjective symptoms do not usually develop until this limit is reached. Anemia is a constant but usually late symptom. Since some persons seem hypersensitive to lead, he does not place absolute reliance on a single symptom, such as granulation of the erythrocytes. Elderly persons and those with a history of lead poisoning are especially susceptible.—K. R. D.

The Lead Kidney with Observations on Renal Arteriosclerosis. *F. Battaglia. Abstr. from Policlinico (sez. med.), 1927, vol. 34, p. 153, in München. med. Wchnschr., Aug. 5, 1927, vol. 74, p. 1343.*

This article deals with an unusually rich clinical material consisting of 31 case histories of renal plumbism followed by autopsy. Of these, 20 showed the contracted kidney of plumbism and death was caused by renal insufficiency, but 11 showed a different clinical anatomic picture. They were all lead workers, 8 had suffered from lead colic and 1 from lead gout, and all gave evidence of kidney disease. Two died of uremia and 9 of some disease independent of the condition of the kidney. The author describes the condition of the kidney in plumbism as an advanced arteriosclerotic cirrhosis. He believes that the primary change is in the vessels and not in the epithelium. An acute or subacute lead-glomerulonephritis has not been proved. Although in the pathogenesis of the lead kidney some part is played by the altered uric acid metabolism of the patient, the chief factor is a direct toxic action on the vessels of the kidney as well as on the arteries of the body in general. It is this that gives lead nephritis its malignant character.—A. H.

Spinal Diseases Caused by Lead. *C. Lewin and R. Treu. Abstr. as follows from Deutsch. med. Wchnschr., Sept. 16, 1927, vol. 53, p. 1587, in Jour. Am. Med. Assn., Dec. 10, 1927, vol. 89, p. 2075.*

Lewin and Treu describe a case in which lead neuritis and phenomena of

spinal cord injury developed in a man in whom the usual symptoms of severe lead poisoning were already retrogressing. On the basis of this clear case, they feel justified in attributing to lead the cord symptoms in another case, in a man who had worked with lead up to one and a half years before but who did not present the classic signs of lead poisoning at the time of their examination. They believe that these cases are important from the standpoint of workman's compensation, and call special attention to the fact that none of the usual criteria of lead poisoning may be in evidence by the time that these late results first appear.—K. R. D.

INDUSTRIAL TOXIC AMBLYOPIA. *M. S. Mayou. Proc. Roy. Soc. Med., May, 1927, vol. 20, p. 1112 (Ophth., p. 44).*

The case reported on is that of a farm laborer employed in spraying fruit trees with a mixture of arsenic, nicotine, and lead. His disks are very pale, "the vessels are of good size, and he has a large central scotoma, with slightly contracted fields. Vision is H. M. each eye." Since starting this occupation his sight has gradually deteriorated, amounting, when reported, only to perception of hand movements. Mayou regards this as a "case of nicotine poisoning brought on by the use of the nicotine and other poisons used in the spraying."—B. A.

CASES OF OCCUPATIONAL DISEASES OF THE SKIN IN THE HANDLING OF NITRIC ACID SOLUTION WHICH CONTAINED DINITROCHLOROBENZOL. *J. Wittenson and M. Czerniawsky. Gigiena Truda, 1926, no. 3, pp. 64–65.*

In the course of five or six days, thirty-two out of forty-eight women workers in a glazed earthenware factory fell ill. The sickness manifested itself in dermatitis, itching, burning, and smarting, localized chiefly on the dorsal surface of the hand and on the lower part of the forearm. Disease of the skin of the hands was also observed in four workers employed in zincography. The investigation showed that the source of the sickness in the workers in zincography and in the women workers of the earthenware factory was the nitric acid used in zincography for etching the zinc plates and in the earthenware factory as an ingredient of the glaze applied to the faïence. On analysis, the presence of dinitrochlorobenzol, $C_6H_3(NO_2)_2Cl$, was detected in the acid. In order to prevent further sickness in these trades, the use of acid containing dinitrochlorobenzol was forbidden.—M. G. P.

CHANGES IN THE OXYGEN CAPACITY OF THE BLOOD PIGMENT OF RABBITS FOLLOWING THE ADMINISTRATION OF NITROBENZENE. *B. B. Stimson. Jour. Biol. Chem., Dec., 1927, vol. 75, pp. 741–744.*

The results of the work described in this paper are summarized as follows:

"Nitrobenzene when given to rabbits by stomach tube produced in the circulating blood a non-oxygen-carrying pigment varying in amount from 2.2 to 14.7 per cent of the total blood pigment. This inactive pigment did not give the spectrophotometric picture characteristic of methemoglobin. It appeared within 7 hours after the administration of the drug."—C. K. D.

THALLIUM, ITS MEDICOLEGAL AND TOXICOLOGIC SIGNIFICANCE. *A. Buschke and E. Langer. München. med. Wchnschr., Sept. 2, 1927, vol. 74, pp. 1494–1497.*

Thallium has come into use in therapy of late because of its property as an epilator in parasitic diseases of the hair follicles, especially in children. If rightly administered it can be depended on to cause epilation in children with almost mathematical certainty on the sixteenth to the eighteenth day. It is also used in several industries, and up to now there has been little literature on the subject of possible poisoning from its use and very little on experimental thallium poisoning.

The authors describe several cases of poisoning with suicidal intent from thallium nitrate or thallium in a rat poison sold freely in Vienna without a poison label. One case of very slow poisoning followed the administration of this paste for the purpose of murder. A gram of this paste contains 0.021 gm. of thallium. The characteristic symptoms in these cases consisted in pains in the joints, sometimes suggestive of acute articular rheumatism, swelling of feet and legs, colic, vomiting, sleeplessness, hyperesthesia and paresthesia of hands and feet, mental confusion, in one case "complete idiocy" just before death, and a striking loss of hair from the head and body occurring in about three weeks after the administration of the poison.

The authors point also to instances in the literature of poisoning following the too rapid administration of thallium for therapeutic purposes, which show that thallium is a very poisonous metal and that a period of two to three months should elapse between the first and second administrations. It is possible to demonstrate thallium in the blood and urine four weeks after the administration of a large dose. It is therefore of importance to call the attention of industrial sanitarians to the danger of the use of this metal in industry. The authors believe that it is used especially in the making of colors and of window glass. Another industry, in which, however, it is being displaced by barium, is the production of luminous paint. Lately Rube and Hendriks have reported severe poisoning in a chemical plant in which thallium was recovered from the flue dust of sulphuric acid works. Six men developed the symptoms already described after a few weeks' exposure, and the one most severely affected had in addition a posterior adhesion of the iris with cloudiness of the lens at the point of adhesion and a slowly progressive yellowish pallor of the optic papilla. He suffered a loss of vision in both eyes, although he recovered from the other symptoms of thallium poisoning. This corresponds with the observations made by Buschke and Peiser and by Buschke and Ginsberg in the chronic thallium poisoning of rats.—A. H.

A REPORT ON THE DISPOSAL OF ZYKLON-B RESIDUE FOLLOWING THE FUMIGATION OF THE HOLDS OF VESSELS. *G. C. Sherrard. U. S. Pub. Health Rep., Dec. 16, 1927, vol. 42, pp. 3071–3075.*

Tests are described in which the residue from hydrocyanic acid fumigation was examined chemically and biologically, showing that the minimum "airing" time of one hour was

commensurate with the safety of the ship's crew.

Because hydrocyanic acid is readily absorbed and slowly released by water, it is evident that Zyklon-B (and presumably hydrocyanic acid fumigants in general) should not be scattered on wet or damp places such as the bilges of ships.—P. D.

HAZARDS IN HANDLING CORROSIVE LIQUIDS. *B. L. Huestis. Safety Engin., Sept., 1927, vol. 54, pp. 95–99.*

The hazards in handling sulphuric, hydrochloric, nitric, and hydrofluoric acids, as well as the so-called anhydrous liquid chlorides, are discussed with special reference to safe packing for shipment.—R. M. T.

INFLAMMABLE LIQUIDS—TROUBLEMAKERS. *B. L. Huestis. Safety Engin., Oct., 1927, vol. 54, pp. 135–138.*

This paper deals with the hazards likely to occur in the transportation of inflammable liquids, liquids that will give off vapors at or below 80°F.

The following rules are suggested for transporting such liquids:

1. These liquids, when in a lightly closed container having proper outage are not dangerous *as long* as they *do not leak;* therefore, the first point is to prevent leaks at any cost, or detect and correct them if discovered.

2. While handling these liquids, whether loose or in containers believed to be tight, all possible chances of ignition must be kept away, which means as far away as humanly possible.

3. Guard against "static" sparks and stray currents by proper grounding.

4. Do not undergo unnecessary exposure to fumes in confined places.

—R. M. T.

PROCEDURE FOR TESTING HOSE MASKS FOR PERMISSIBILITY. *U. S. Bur. Mines, Schedule 19, April 28, 1927, pp. 8.*

"The purpose of the investigations under this schedule is to provide a list of hose masks which may be safely used in tanks and apparatus used in mineral industries or elsewhere as a protection from irrespirable atmospheres."

The materials to be submitted, fee, application form, etc., are given in detail. The "general requirements" and "specific requirements" with details of the tests applied are given so concisely and clearly that the interested reader would better obtain the original schedule. Companies using protective equipment could make most of these tests at regular intervals on their own premises, in order to see whether or not the equipment, most of which is made of rubberized fabric, deteriorates with age and use.—P. D.

INDUSTRIAL GAS MASKS. *R. Hanslian. Abstr. as follows from Ztschr. f. d. ges. Schiess- u. Sprengstoffw., 1927, vol. 22, pp. 150–152, in Chem. Abstr., Nov. 20, 1927, vol. 21, p. 3994.*

For every existing industrial need a reliable gas mask is available. The *mouth respirator* affords no protection for the eyes but with the proper chemical filling in the canister it will give adequate protection against vapors of organic solvents, acid fumes, ammonia, hydrocyanic acid, hydrogen sulphide and dusts such as are produced in the alkali industry, in sand blasting, in paint spraying, etc. The *adsorptive capacities* of the various types of chemical fillings for the re-

placeable snout canister of the *German army type mask* are: Type A, 22.5 gm. acetone, 10.5 gm. benzene; Type B, 7.5 gm. phosgene, 6.1 gm. hydrochloric acid, 6.1 gm. oxides of nitrogen; Type E, 20.5 gm. sulphur dioxide, 20.5 gm. hydrochloric acid, 8.3 gm. oxides of nitrogen; Type F, 8.4 gm. chlorine, 0.34 gm. ammonia, 3.3 gm. hydrogen sulphide, 0.6 gm. chloropicrin, 3.45 gm. sulphur dioxide; Type G, 2.5 gm. hydrocyanic acid; Type K, 2.9 gm. ammonia; Type L, 4.5 gm. hydrogen sulphide; Type M, 1.2 gm. hydrogen sulphide, 2.4 gm. ammonia; Type O, 13.1 gm. phosphine, 12.6 gm. arsine. Protection against mists and smokes requires a larger canister, which is carried on the chest or the back. A special chemical filling (*Hopcalite*) is required for protection against carbon monoxide. A warning agent is used in the canister to indicate the break-point against carbon monoxide. The *Universal canister* contains the required chemical filling to protect not only against carbon monoxide, illuminating gas, water gas, producer gas, blast-furnace gas, stack gas, suffocating gases resulting from explosions of fire and coal dust, provided the oxygen supply remains sufficiently high, but also against vapors of organic solvents, acid fumes, chlorine, ammonia, hydrogen sulphide and arsine.—P. D.

THE MODERN KNIGHT IN ARMOR. *Nat. Safety News, Sept., 1927, vol. 16, pp. 19–20.*

Where the hazards of occupation include the handling of hot metals, acids, caustics, and other corrosive substances, the wearing of protective clothing is needed. Three essentials in protective clothing are recognized: (1) The garment must be reasonably comfortable in any temperature. (2) It must fit as well as street clothing. (3) It must be durable and afford adequate protection against the hazards for which it was designed.—R. M. T.

DUST HAZARDS AND THEIR EFFECTS

THE DUST-CELLS OF THE LUNG. *Reprinted from Lancet, Nov. 5, 1927, vol. 2, p. 982.*

Anyone who lives in London and looks with the microscope at a bit of the grayish or brownish mucoid sputum which he coughs up in the morning will see a most exquisite example of phagocytosis of dust particles by large clear cells. It is the normal mechanism which does its best to keep our lungs as clear of extraneous matter as may be. Histologic sections of the lung of anyone who breathes dirty air show the same picture which is developed to an extreme degree in mitral stenosis, when the remnants of red blood corpuscles which have oozed through the distended capillaries are taken up in great quantities by the similar "heart failure" cells. It used to be thought that these phagocytic cells came from the epithelium lining the alveoli, irritation leading to their proliferation and detachment. But in recent years this origin has been much disputed, and it has been supposed that they were endothelial cells from the lung capillaries or histiocytes from the

alveolar walls. A. Policard (Lyons) has combined two views in his hypothesis, that they come from the lining of the alveoli, and that this is mesodermal rather than epithelial. Dr. H. M. Carleton, of Oxford, has recently[1] reexamined the question in a variety of ways—histology, vital staining, tissue culture—and comes to the conclusion that dust cells are indeed derived from the cells lining the alveoli, and that these are epithelial in nature; in other words, he reaffirms the original interpretation. Phagocytosis by epithelial cells is not really so very uncommon, even in mammals; many cancers show an exaggerated degree of it. These epithelial dust cells are, perhaps, chiefly peculiar in their capacity for ameboid movement, for after picking up particles in the alveoli they will penetrate the lymphatics of the lung, and travel long distances in these vessels and to the bronchial glands.

Pulmonary Asbestosis. *W. E. Cooke. Brit. Med. Jour., Dec. 3, 1927, vol. 2, pp. 1024–1025.*

The clinical history is given of a woman who was exposed in a factory to asbestos dust for eighteen years, before she ceased work in 1922. She then came under notice presenting signs of fibrosis of the right lung and tuberculosis; she died two years later. The lungs showed an enormous amount of fine granular pigment in peribronchial fibrous tissue, in the walls of alveoli and in phagocytes. Numerous particles of dust similar in size and shape to asbestos dust were to be seen; and in addition certain large solid angular particles, quite unusual, arising apparently from the dust.

Some short description is given of the use of asbestos during historic time; it has been known since the days of Herodotus. In composition it is a mineral mainly composed of hydrated magnesium silica. A chemical analysis yields about 43 per cent. magnesia, 40 per cent. silica, and 14 per cent. water. A certain amount of oxide of iron is also usually present; the iron appears as dark particles among the translucent asbestos fibers. The fibers may be of great length and fineness so that cloth made with them can weigh less than 8 ounces to the square yard.—E. L. C.

Histology of Pulmonary Asbestosis. *S. McDonald. Brit. Med. Jour., Dec. 3, 1927, vol. 2, pp. 1025–1026.*

This article is devoted to the histologic appearances seen in the case reported by Dr. W. E. Cooke. (See previous abstract.) Well-marked diffuse interstitial pneumonia was present with chronic bronchitis and some emphysema. There was also extensive pigmentation with signs of chronic phthisis. The typical whorled formations seen in silicotic lungs were not present. A distinctive characteristic was the presence of certain large fragments varying in size from 20 microns to 70 microns or even larger. These curious bodies look like organic structures with club-like extremities. They were submitted to pathologists, zoologists, botanists, and chemists; but no one could identify them. The hypothesis is advanced that these bodies are portions of asbestos fibers in the process of alteration and ab-

[1] Carleton, H. M.: Quart. Jour. Micros. Sci., 1927, vol. 61, p. 223.

sorption by hydrolysis either by direct chemical action or by enzymes; but the exact nature of these foreign bodies remains in doubt. (Special plates are given of photomicrographs illustrating the papers by Dr. Cooke and Dr. McDonald.)—E. L. C.

CLINICAL ASPECTS OF PULMONARY ASBESTOSIS. *T. Oliver. Brit. Med. Jour., Dec. 3, 1927, vol. 2, pp. 1026–1027.*

This article is a short note dealing with the same case as is reported by Dr. Cooke and Dr. McDonald; it follows the same lines as the article which appeared in THIS JOURNAL (1927, vol. 9, p. 483).—E. L. C.

EFFECTS OF COAL DUST UPON THE SILICOTIC LUNG. *S. L. Cummins. Jour. Path. and Bacteriol., Oct., 1927, vol. 30, pp. 615–619.*

The occurrence of silicosis among those coal miners in South Wales who are employed driving roads in hard silica rock was reported in THIS JOURNAL (1926, vol. 8, p. 466) by Tattersall. An account is given in this paper by Prof. S. L. Cummins of the pathologic findings in the case of one of these miners who after being exposed to silica dust for four years at machine drills was subsequently employed as a coal miner at the face. Neither during life nor after death were tubercle bacilli found. On chemical analysis the lungs were found to contain a little over 10 per cent. of ash of which 1.4 per cent. was composed of silica. Ash from the lungs of an ordinary adult gave only 3.2 per cent. ash with an inconsiderable amount of silica. Microscopically the lungs exhibited definite and characteristic fibrosis; in addition, a great accumulation of pigment originating in coal dust was found, so much so that the upper parts and surface of the lungs felt and looked like coal. Many dust bearing macrophage cells were to be seen in the fibrotic tissue, carrying particles of coal dust. Others had disintegrated leaving their burden of coal dust behind. The writer compares the occupational exposure of the patient to that obtained on animals by Mavrogordato who exposed guinea-pigs first to fine silica dust and subsequently to fine coal dust. The findings closely followed those now reported. The suggestion is put forward that the lungs were first damaged in their lymph drainage by the fibrosis; subsequently coal dust became entangled there which would have been eliminated from normal healthy lungs. The result was that coal dust, which is usually considered a harmless dust, so accumulated in the lungs that it accentuated the preexisting silicosis sufficiently to lead to death.—E. L. C.

A NEW KONIMETER. *R. A. H. Flugge de Smidt. Jour. Chem., Metall. and Min. Soc. So. Africa, Oct., 1927, vol. 28, pp. 78–80.*

A brief description, with illustration, is given of a circular konimeter with microscope attached, designed by the Carl Zeiss Co., Jena.—P. D.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

"The Common Cold"—Etiology, Prevention and Treatment. *V. S. Cheney. Am. Jour. Pub. Health, Jan., 1928, vol. 18, pp. 15–21.*

The conclusion to this paper, by the medical director of Armour and Company, Chicago, is given as follows:

Colds and their sequelae including rhinitis, pharyngitis, laryngitis, bronchitis, la grippe, influenza, and pneumonia are not infectious, as we generally consider a disease to be infectious, but are due to a disturbance of the alkaline reserve or balance (acid-base equilibrium). The more severe the degree of disturbance, the more serious the disease.

Conditions capable of producing a mild acidosis or disturbing the "buffer" action of the blood plasma, are contributing factors in producing a cold: a poorly balanced diet, lack of exercise, fatigue, constipation, and infections anywhere in the body. Colds can be prevented by maintaining the alkaline balance through proper diet, exercise, and the careful use of sodium bicarbonate or alkaline waters.

Colds can be aborted by administering sodium bicarbonate in doses large enough to thoroughly alkalinize the system together with small doses of calcidin or iodine and calcium.

Colds can be cured by the administration of the same drugs in smaller and frequently repeated doses.

An interesting discussion follows the paper, to which several industrial physicians contribute their views.—B. A.

Importance of Chronic Arthritis in Industrial Work. *C. E. Rees. Calif. and Western Med., July, 1927, vol. 27, p. 77.*

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

Multiple Primary Paraffin Carcinomas. *E. Spitzer. Wien. klin. Wchnschr., Sept. 15, 1927, vol. 40, pp. 1174–1175.*

The patient whose case is described had worked for forty-four years in a mineral oil refinery, extracting paraffin from crude oil residue, the most dangerous process in oil refining, because the workers come into direct contact with the soft oil cakes. The face and the hands are spattered from the oily mass and the clothing becomes saturated with oil products.

The empyreumatic materials in the crude oil are the chief cause of paraffin itch and paraffin carcinoma. The mechanical irritation through the crystalloid nature of the paraffin scales must play only a subordinate rôle since no skin diseases are found among the workers in the candle factories where the finished product, pure paraffin, is handled. In addition to the chemical irritation, there must be a certain susceptibility of the skin, in which the age of the person and the condition of the skin play a part.

The chief sites of paraffin carcinoma are the face and hands and the scrotum. Chimney sweeps' cancer, cotton spinners' cancer, and tar cancer are mentioned as being clinically and etiologically similar to paraffin cancer.

The author suggests as prophylactic measures: improvement of the me-

chanical operations, removal of dangerous fumes and dust, introduction of protective clothing—to be washed at regular periods—provision of washing and bathing facilities for the workers, greasing the skin before work, and medical supervision.—M. C. S.

THE CLINICAL INCIDENCE AND ASPECTS OF TRADE SKIN CANCERS. *R. P. White. Jour. State Med., Sept., 1927, vol. 35, pp. 522–534.*

Specificity must be present in an agent before it can initiate a cancer. This fact we have learned from a study of occupational skin cancers. Such agents appear generally to be keratogenic. Instances of "acute" cancers developing before the originating trauma has healed are so few as to suggest that they may be chance cases of injury to an already determined cancer. "Latent" cancer developing on the site of an old scar or injury is more definite; but even so, literature provides a limited list of cases. Cancer following burns and scalds is recorded, but the number of cases is extraordinarily small. Yet thousands of wounds, burns, and scalds occur daily. Radiant heat as a promoter of malignancy must give way to ultraviolet rays which in industry occur only at high temperatures, *e.g.*, the electric furnace. Distillation products of vegetable matter, whether of coal or of tobacco, appear to possess carcinogenic properties. Of inorganic things arsenic is the only one against which the evidence is fairly conclusive. A biologic precancerous stage seems to precede a local cancer; it may be free from local or general manifestation, but it must be present to permit a specific agent to exert its specific carcinogenic influence.—E. L. C.

SPOROTRICHOSIS AMONG SOUTH AFRICAN NATIVE MINERS. *A. Pijper and B. D. Pullinger. Abstr. as follows from Lancet, Oct. 22, 1927, vol. 2, p. 914, in Jour. Am. Med. Assn., Dec. 17, 1927, vol. 89, p. 2147.*

In South Africa, sporotrichosis so far has been unknown. Pijper and Pullinger report fourteen cases. The fungus isolated was *Rhinocladium beurmanni*. Animal experiments were positive.—K. R. D.

INDUSTRIAL EYE INJURIES. *J. B. Stanford. South. Med. Jour., May, 1927, vol. 20, pp. 398–402.*

After deploring the methods of the "shop oculist" and urging the adoption of measures in all plants to prevent untrained men from attempting to remove foreign bodies from the eye, the author outlines the method which he has successfully used.

Cases of acute conjunctivitis following the lodging of sawdust on the conjunctiva of the lid have been seen by the author, not unlike the so-called "swimming pool" conjunctivitis. He has been unable to associate them with the dust from any particular wood or from wood treated in any particular way.

Dr. Stanford outlines his treatment for the following: infected wounds of the cornea; corneal abrasions and contused wounds of the eye such as are common in woodworking plants from "fly-backs;" and perforating wounds of the eyeball. In perforating wounds care must be taken to determine the presence or absence of intra-

ocular foreign bodies. Their location is also of great importance. The author has found that the danger of infection in these cases "is in direct ratio to the length of time the wound is left open." He therefore operates immediately when patients with such injuries are sent to his office, rather than wait until the patient can be sent to the hospital. If necessary, the patient can be sent there later. Dr. Stanford gives briefly the procedure which he uses in these operations and in removing foreign bodies when present.

Proper lighting in shops, proper guards for machines, and enforcement of rules as to wearing of goggles in certain occupations would have prevented many of the accidents with which the author has had to deal. He concludes his address with a plea for a standard by which the percentage of permanent visual defect may be justly determined.

An interesting discussion follows the paper.—B. A.

INTRAOCULAR FOREIGN BODIES AND PERFORATING INJURIES OF THE EYE. *Am. Jour. Ophth., July, 1927, vol. 10, Soc. Proc., pp. 527–528.*

"Dr. Joseph W. McKee dealt with the advisability and method of removal of different types of intraocular foreign bodies. He advised the removal of all magnetic foreign bodies from the globe providing there has not been too severe laceration at the time of injury. Nonmagnetic foreign bodies may be removed from the anterior chamber and lens with a fair degree of success. He feels that any attempt to remove nonmagnetic foreign bodies from the vitreous chamber is likely to do more harm than good.

"The prognosis depends to a large extent upon the size and consistence of the foreign substance, the amount of trauma to the ocular structures at the time of injury, whether any infection was carried into the globe or not and upon the removability of the foreign body, each case being a problem unto itself.

"Five cases were presented where the foreign body had been removed from the vitreous chamber. All were cases of steel removed thru scleral incisions after localizations by the Sweet method, three cases getting 20/20 vision, one 20/40 vision, and one 10/200 vision."

EXPERIENCES IN EXTRACTION OF MAGNETIC FOREIGN BODIES. *O. Barkan and H. Barkan. Am. Jour. Ophth., Dec., 1927, vol. 10, pp. 919–921.*

"Personal experiences of extraction of steel from behind the iris are here reported. In 61 cases 11 eyes were enucleated. Certain features of these cases are brought out. Siderosis was present in eight cases after periods of one month to four years. Extraction thru the sclera and by the anterior route are compared. In the anterior extraction adrenalin mydriasis proved of special value."

MINERS' NYSTAGMUS IN A SURFACE WORKER. *H. S. Russell. Reprinted from Brit. Med. Jour., Aug. 13, 1927, vol. 2, p. 267.*

Dr. Freeland Fergus in a recent communication referred to the occurrence of occasional cases of miners' nystagmus among pithead workers, but stated that no such case had come within his own experience. If any undoubted case of miners'

nystagmus can be demonstrated in which the disease developed in spite of adequate illumination of the working place, doubt is at once thrown on the validity of the deficient light theory of the causation of the disease.

T. F., a miner, aged 44, first came under my care in February, 1926, complaining of cough, expectoration, and loss of weight, which were soon found to be due to early pulmonary tuberculosis. With the exception of trench fever in France he had never had any illness. He did well under sanatorium treatment, and was able to resume work in January, 1927.

He had an attack of influenza during the last epidemic, and has not been able to return to work since. I noticed nystagmoid movements in June, 1927. The man, on questioning, admitted that his eyes had felt weak for a few days and that he felt giddy in the twilight. Apart from the fact that he has pulmonary tuberculosis he is a typical case of miners' nystagmus, but he has never been underground. An agricultural labourer before the war, he only went to the pit in 1919. Since then he has been employed on the top, working in daylight, but exposed to coal dust.

It is just possible that the nystagmus may be due to an intracranial tubercle, but there is nothing to support this idea, and I personally regard the case as one of true miners' nystagmus. It is possible that the nystagmus was due to a toxin in the coal dust, as Dr. Fergus suggests, but in any case illumination could have nothing to do with it.

Many cases of miners' nystagmus pass through my hands, and I have examined the pupil with great care. Apparently there is no dilatation. . . . . The chief symptoms of the disease, however, might well be due to hypertonicity of the sympathetic nervous system, and the conditions under which a miner works certainly involve overaction of this system—for example, the maintenance of unnatural posture and a fully dilated pupil.

It appears to be fairly well established that miners' nystagmus is associated with lack of light. There is considerable evidence, from work done at Jesionek's clinic at Giessen, that ultra-violet light has a definite effect on the sympathetic nerve endings. Also in Raynaud's disease good results have been obtained by treatment with ultra-violet light, and this is said to be due to indirect action through the sympathetic nerves.

It seems possible, therefore, that a considerable deprivation of actinic light during a man's employment as a miner, combined with the extra call upon the sympathetic nervous system due to unnatural posture and dilated pupil, may bring about a more or less permanent condition of sympathetic hypertonicity. Such sympathetic hypertonicity might account for all the symptoms of miners' nystagmus—tachycardia, disordered tone of the eye muscles (clonus?), sweating, psycho-neurotic changes, etc.

This suggestion is merely tentative and naturally can only be expressed in outline here, but the chain of evidence is so strong that it seems worth while to test the effect of actinic light upon patients suffering from miners' nystagmus. For some time past I have been investigating this matter, and arrangements have been made for me to test the treatment.

THE SYMPATHETIC SYSTEM IN MINERS' NYSTAGMUS. *R. S. Brock. Reprinted from Brit. Med. Jour., Aug. 20, 1927, vol. 2, p. 308.*

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

TEMPERATURE GRADIENTS IN THE TISSUES IN MAN. *H. C. Bazett and B. McGlone. Am. Jour. Physiol., Oct., 1927, vol. 82, pp. 415–451.*

The authors measured the temperatures in the forearm, thigh, and vessels of human subjects under varying environmental conditions by thermoelec-

tric methods, using steel hypodermic needles which contained light gauge thermocouples.

The temperatures of the muscles of the forearm close to the bones were, under normal conditions, commonly 1° to 2° below the rectal temperatures.

The surface temperatures of the bare forearm in two subjects followed the basic scale of the effective temperature index fairly well. Correlations with the dry or wet bulb temperature and with the kata cooling power were poor. The relation of surface temperature to effective temperature was not identical in the two subjects, because of their different thermal reactions.

The gradients observed for the same environmental conditions varied in different subjects, but the same gradient was usually noted in any one subject, if conditions were comparable.

Cold conditions were associated with comparatively high thermal gradients in both the superficial and the deeper parts of the fat and with a considerable gradient in the superficial layers of muscle. Warm conditions induced thermal gradients of a low order; whereas comfortable environments were associated with moderately high gradients in the superficial part of the subcutaneous fat and with a very low gradient in the deepest part of the fat; a gradient in the superficial layers of the muscle might or might not be present.

Data were also obtained on the changes in rectal temperature, surface temperature, and spatial thermal gradients as the result of swimming in cool sea water.—C. P. Y.

THE TEMPERATURE OF THE AIR IN CONTACT WITH THE SKIN. *B. McGlone and H. C. Bazett. Am. Jour. Physiol., Oct., 1927, vol. 82, pp. 452–461.*

It is a well-known fact that the temperature of the air in contact with the skin is not identical with the temperature of the atmosphere in which the body is exposed; it approaches, within a few degrees, the skin temperature. When clothing is worn, this approximation is closer.

McGlone and Bazett describe a delicate thermoelectric method for determining the temperature of the air adjacent to the bare skin up to a distance of 6 mm. from the surface. This temperature was found to vary, to some extent, with the cooling power of the atmosphere (cooling power of the atmosphere depends upon its temperature, moisture content, and the amount of air movement). Under ordinary conditions of comfort, the temperature of the warm layer of air 1 mm. distant from the skin surface of the bare extensor aspect of the forearm was less than 1°C. below that of the surface.

Hair was found to affect the temperature of the air adjacent to the skin appreciably by reducing the circulation of air.

It is not stated whether the thermocouples used for determining the temperature of the warm layer of air were shielded from radiation of heat from the skin. If this were not done, the temperatures might be slightly higher than they should be.—C. P. Y.

PHYSIOLOGICAL RESPONSES TO HEAT. *H. C. Bazett. Physiol. Rev., Oct., 1927, vol. 7, pp. 531–599.*

This is a well-rounded discussion of the physiologic responses of man to external heat, dealing for the most

part with recent research (1900 to 1927) but containing references to earlier literature.

The author's chief contribution in this paper is his able assimilation of the facts and advancement of theories which, to a great extent, account for the discrepancies in the literature. He enters a plea for a more careful study of the effects of local change in temperature on physiologic processes in mammals and warns against the prevalent assumption that the temperature recorded in the trunk is the temperature which exists throughout the whole organism.

The article is followed by an excellent bibliography.—C. P. Y.

WOMEN AND CHILDREN IN INDUSTRY

THE PHYSIQUE OF WOMEN IN INDUSTRY. *E. P. Cathcart, E. M. Bedale, C. Blair, K. Macleod, E. Weatherhead, and S. G. Overton. Indust. Fatigue Res. Board, Rep. No. 44, pp. 137. H. M. Stationery Office, 1927.*

The problem approached in this report, issued by the Industrial Fatigue Research Board, upon research work carried out, called for investigation of anthropometric data of women in industry, the physiologic cost of porterage, and determination of loads actually carried. It follows up previous work by E. M. Bedale who investigated the effects of posture and rest in muscular work for the Board. The conclusions, previously advanced somewhat tentatively in the earlier report, are entirely confirmed. Physique was measured by taking heights, weights, and strengths; the last being determined by pulling, gripping, and crushing between both hands against a calibrated spring. During the inquiry 4,366 women were examined, taken from various sources, some being university students, but most of them industrial operatives. Other investigations, on similar lines, of males have shown that university men are of finer physique than the working population; this investigation establishes that the same thing holds good for females. The college students were heavier and taller and able to exert greater strength than the operatives; not only so, but, after allowance had been made for weight, they were able to exert more strength for each stone of weight. The facts suggest that mental acuity enables the possessor to obtain greater efficiency from her muscles. Within the operative group the same principle was found to hold good, since those examined from an unemployed group were shorter and stouter than those from the employed; they also were less capable of obtaining an efficient response from their muscles. They seemed to be unemployed possibly because they were to some extent unemployable.

The question which the investigators were called upon to answer was: What is the optimum load which women should be permitted to carry? The way in which this problem was tackled is described. The cost of the effort made was measured by increase in metabolism when measured with the respiratory apparatus. The effect upon pulse and blood pressure was also noted. The cost of carriage of

loads seemed to depend on the disposition of the load; any load which brought about considerable departure from the erect posture inevitably led to a high physiologic cost. A general correspondence was noted between the findings of the metabolic determinations and those of the circulatory reactions. Finally the conclusion is arrived at that for ordinary continuous carrying the load should be about 40 per cent. of the body weight, and for irregular effort about 50 per cent. For females of average weight these percentages work out at about 45 pounds and 55 pounds respectively. The disposition of the weight is important, and 50 pounds for "well-disposed" loads, and 40 pounds for "ill-disposed" loads is about the maximum economic load for women engaged in continuous work.

Investigations were made in a number of industries known to be heavy, such as the manufacture of tin plates, pottery, sanitary pipes, bricks, cotton, paper, and engineering works, with regard to the lifting of loads by women and young persons. These investigations quite remarkably agreed with the conclusions already arrived at by observation of physiologic cost in the laboratory. The women appeared to be generally self-protective in their choice of the size of load, and to know to a nicety their own capacity. Any tendency to select heavier weights was manifested only by young persons eager to show their strength; this group alone appeared to require supervision in their work. Definite injury resulting from the strain of carrying was not brought to light. Where definite weights were required to be moved, they were always found well within the capacity of the worker. As might possibly have been anticipated, women of the best physique were found employed where the work was heaviest. Such work may attract the strongest women and also may help to develop their physique; on the other hand, those below the average tend to filter through to a level of work which is within their capacity.

The position with regard to legal enactments governing weight carrying in various countries is set out in an appendix to the report. The divergence of practice in this matter demonstrates the need for an investigation such as has now been carried out. Apart, however, from the answer given to a practical question, the data collected and now placed on record are a valuable addition to knowledge. The report contains a wealth of clever statistical matter, useful illustrations, and diagrams.—E. L. C.

PRESENT DAY PROBLEMS OF WOMEN IN INDUSTRY. *E. M. Johnson. Nation's Health, July, 1927, vol. 9, pp. 20–22, 70.*

The author states that "In spite of the progress made by women, the mass of women in industry throughout the country are untrained, unorganized, and poorly paid." Until more adequate educational training is assured, and until they are far more effectively organized than they are at the present time, their protection must come mainly through special legislation. Problems to be considered are: the effect of some of the newer employments on the health of women; the kind of industrial training that will meet the needs of women workers;

and how to overcome the age-long prejudices that stand in the way of thorough educational preparation for women and girls.—M. C. S.

HOURS AND EARNINGS OF WOMEN EMPLOYED IN POWER LAUNDRIES IN NEW YORK STATE. *N. Y. State Dept. Labor, Bull. No. 153, 1927, pp. 72.*

This study supplements the report published in 1924 as Special Bulletin No. 130 entitled "A Study of Hygienic Conditions in Steam Laundries and their Effect on the Health of the Workers," and completes the picture of working conditions in steam laundries as far as women workers are concerned.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

THE EFFECT OF ILLUMINATION AND OTHER FACTORS ON ACUITY OF VISION. *H. Banister, H. Hartridge, and R. J. Lythgoe. Abstr. as follows from Brit. Jour. Ophth., 1927, vol. 11, p. 321, in Am. Jour. Ophth., Nov., 1927, vol. 10, pp. 873–874.*

The authors summarize their investigations as follows:

1. An investigation was made on the effect of illumination on visual acuity (a) where the test objects subtended only a small angle and were viewed for a prolonged period, and (b) where the test objects subtended a considerable angle but were viewed for only a fraction of a second.

2. By these methods we investigated the effect of intensity of illumination on visual acuity, (a) for normal sighted observers, (b) for normal sighted observers given defective vision by means of glasses, and (c) for observers with abnormal vision. In each case we found a clearly marked increase in visual acuity as the illumination was increased up to about 100 foot-candles. Beyond this intensity no further increase could be found.

3. The range of 1–100 foot-candles covers that ordinarily met with in artificial illumination. An increase in the intensity from 1 to 100 causes only a two-fold increase in visual acuity.

4. Artificial illumination of 2–4 foot-candles is most probably fully adequate for a variety of purposes.

For very fine work on the other hand, where the maximum visual acuity is required, an intensity of 100 foot candles should be found adequate.

SMOKELESS LAUNDRIES. *Abstr. as follows from Illumin. Eng., 1927, vol. 20, pp. 259–261, in Bull. Hyg., Dec., 1927, vol. 2, p. 973.*

This article describes, and illustrates, the working of a modern laundry.

From the hygienic aspect its chief interest lies in its account of the use of irons heated internally by high pressure gas, the temperature being regulated by the ironer by means of a by-pass controlling the gas delivery and at the same time automatically regulating the supply of air. [No mention is made of any precautions to insure good ventilation of ironing rooms full of workers each with one of these gas burning irons discharging its fumes into the rooms' air.]

INDUSTRIAL NURSING

INDUSTRIAL NURSING AND SAFETY. *E. Raub. Safety Engin., Aug., 1927, vol. 54, pp. 70–71.*

Important work can be done by the industrial nurse in promoting pleasant industrial relations; in minimizing results of accidents by first aid treatment and follow-up care; in reducing time lost and in inquiring into causes of accidents and illnesses.—R. M. T.

INDUSTRIAL INVESTIGATIONS AND SURVEYS

WAGES AND HOURS OF LABOR IN WOOLEN AND WORSTED GOODS MANUFACTURING, 1910 TO 1926. *U. S. Bur. Labor Statistics, Bull. No. 443, July, 1927, pp. 44.*

WAGES AND HOURS OF LABOR IN THE BOOT AND SHOE INDUSTRY, 1907 TO 1926. *U. S. Bur. Labor Statistics, Bull. No. 450, Sept., 1927, pp. 98.*

WAGES AND HOURS OF LABOR IN THE HOSIERY AND UNDERWEAR INDUSTRIES, 1907 TO 1926. *U. S. Bur. Labor Statistics, Bull. No. 452, Oct., 1927, pp. 72.*

HOURS AND EARNINGS IN BITUMINOUS COAL MINING, 1922, 1924, AND 1926. *U. S. Bur. Labor Statistics, Bull. No. 454, Nov., 1927, pp. 66.*

PRODUCTIVITY OF LABOR IN THE GLASS INDUSTRY. *U. S. Bur. Labor Statistics, Bull. No. 441, July, 1927, pp. 204.*

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

MACHINE SPEEDS AND OUTPUT. *S. Wyatt. Jour. Nat. Inst. Indust. Psychol., Oct., 1927, vol. 3, pp. 406–414.*

Observations were made on the workers at a toffee factory, who were employed in feeding machines with squares of toffee. It was essential for the operative to keep the moving disk supplied with toffee, and the machines were kept going at a rate well within the capacity of the slowest worker. During a period of six weeks the machines of two workers were speeded up at the rate of three or four units per week, and it was found that their output improved when the speed was increased to 81, from its initial value of 68.5; but at a higher speed it began to fall off. The output kept fairly steady throughout the working day, though it increased rather more toward the end of the day when the machines were going at the 81 speed—*i.e.*, there was no indication of fatigue. Similar results were obtained with groups of twelve and eighteen workers who were supplied with toffee by means of a conveyor. It was found in their case that output could be increased by an amount varying from 5 to 15 per cent. without any appreciable increase in discomfort or fatigue.

The conclusion drawn from these results, and from others obtained in the laboratory, is that machines ought

to be so arranged that they can be run at various speeds, to suit individual workers. As soon as a worker on a slow machine approaches an efficiency of 100 per cent., she should be promoted to a faster machine. Individual differences in ability would in consequence be adequately expressed in productive efficiency.—H. M. V.

THE VALUE OF STOPPAGE ANALYSIS WITH SPECIAL REFERENCE TO WEAVING. *J. A. Fraser. Jour. Nat. Inst. Indust. Psychol., Oct., 1927, vol. 3, pp. 422–431.*

The industrial psychologist and the employer of labor require a detailed explanation of the variations in the efficiency of the worker. For instance, is a fall of output due to a loss of working efficiency, or to an increase in the amount of unproductive time? And is a loss of unproductive time due to factors dependent on the worker, such as inattention, or to factors over which he has no control, such as lack of material or breakdowns of machinery? Information of this kind can be best obtained by stoppage analysis.

The nature, number, and duration of all the stoppages experienced by one weaver were analyzed during alternate half-hourly intervals for a period of two months. She was controlling four looms, and the efficiency of the looms differed distinctly, for various mechanical reasons. On an average, there was a loss of productive time of 24 per cent., a third of this time being taken up in reshuttling, and a fifth by warp breakages. It appeared that talking and inattention accounted for 8 per cent. of the time lost. The conclusion reached as the result of the stoppage analysis was that weaving efficiency depends as much on the methods adopted by the weaver as on the speed with which she performs certain standard operations. The weaver in question did not organize her work well so as to distribute attention over her four looms, and in complicated situations she lacked ability to discriminate which loom should first receive attention. She had not thoroughly realized that when stoppages occur simultaneously it is always best to deal with the shorter stoppages first.

These and similar observations might be used at a training center, in order to determine whether candidates should or should not be retained.—H. M. V.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

FACTORY LEGISLATION. *R. J. Davies. Jour. Roy. San. Inst., Dec., 1927, vol. 48, pp. 308–313.*

This paper is devoted to consideration of the Consolidating Factory Bill now before parliament. It abolishes the legal distinction between factories and workshops, and would link up the school medical service with that of the certifying factory surgeon; but a factory medical service, over and beyond, is needed on the plan followed by farseeing firms. History contradicts the claim that restriction of bad employers hampers successful industry. The uncontrolled work of "skiller" boys at docks is quoted, who work as casual laborers

in pipes about 16 inches by 12 inches for hours on end and come out covered with oil and grease to travel home in the city cars. Good factory law well enforced by an adequate staff of expert inspectors is a good investment.—E. L. C.

REHABILITATION OF DISABLED EMPLOYEES

THE ESTABLISHMENT OF OCCUPATIONAL THERAPY CLINICS IN CO-OPERATION WITH A STATE DEPARTMENT OF REËDUCATION OF DISABLED PERSONS. *M. R. Emig. Occup. Therapy, April, 1927, vol. 6, pp. 149–153.*

Working on the principle that occupational therapy is incomplete unless carried through to rehabilitation, the Duluth Occupational Therapy Association has proved the value of co-operation with hospitals and the state department of rehabilitation. Miss Emig gives an interesting account of one of the cases coming under her direction.—B. A.

THE INTER-RELATION BETWEEN OCCUPATIONAL THERAPY AND SUBSEQUENT VOCATIONAL OR INDUSTRIAL REHABILITATION. *O. M. Sullivan. Occup. Therapy, June, 1927, vol. 6, pp. 175–180.*

"Occupational therapy is the best and most desirable foundation on which to project vocational rehabilitation" and "vocational rehabilitation is often the essential phase to complete the restoration process begun by occupational therapy"—this formula applying chiefly to instances of permanent disability. Mr. Sullivan, who is State Director of Re-education of Disabled Persons, St. Paul, Minn., calls attention to the evil effects of idleness and of improper treatment resulting in impairment of function, and to the difficulties of vocational advisement, in connection with the first part of the formula of interrelation, and to the value of curative workshops and community and factory co-operation, in connection with the second part. In other words, the problem of the disabled person should be met not with a cross-sectional viewpoint according to various specialties of effort, but with a recognition of the unity of all forces in order to accomplish the end in view.—B. A.

THE CURATIVE WORKSHOP FROM THE VIEWPOINT OF INDUSTRIAL ACCIDENT COMPENSATION. *W. F. Faulkes. Occup. Therapy, Aug., 1927, vol. 6, pp. 253–264.*

"The curative workshop is one of the most important factors in cutting down compensation awards, and returning the worker to the job within the shorter time." Data are given from observation of the work of the Curative Workshop in Milwaukee, Wis.—B. A.

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

HEALTH AND EFFICIENCY IN FACTORY AND WORKSHOP. *Leverhulme. Jour. State Med., Aug., 1927, vol. 35, pp. 450–457.*

In this address, which he delivered, as president, to the Section of Industrial Hygiene of the Congress of the Royal Institute of Public Health, at Ghent, Viscount Leverhulme outlines the responsibilities of employers in protecting the health of their workpeople and in guarding them against accidents. Statistics and illustrations are drawn from the factory of Lever Brothers at Port Sunlight.—E. D.

INDUSTRIAL HYGIENE AND SAFETY. *Internat. Labour Office, Indust. and Labour Information, Jan. 16, 1928, vol. 15, pp. 60–68.*

This informatory article contains items gathered from different countries. The number of industrial accidents in Russia are quoted as having increased in 1926 when compared with the previous year; in coal mines the

number per thousand workers was 213, as compared with 170; in petroleum 154, as compared with 81; in iron and copper mines 187, compared with 153; and in salt mines 87, compared with 43. The increase in fatalities in underground work was 27 per cent. The increase is attributed to exploiting old pits and mines while technical protection is inadequate. When the mining industry is compared with other industries, the number of fatal accidents per thousand workers was 1.3 compared with 0.3 for iron and steel manufacture, 0.2 for chemical works, and 0.05 for textile factories.

An abstract is given of precautions proposed in Australia in the manufacture and use of lead paints. They should only be issued and used in the form of paste; they should not be used in spray form for interiors; dry rubbing down should be stopped; suitable overalls should be worn and kept clean; and respirators, where necessary, should be provided; wet rubbing down is recommended and the provision of washing accommodation for the workers. Non-lead paints should be given preference where spray painting is done; for which the use of benzol or wood alcohol as a solvent should be prescribed. Other recommendations for progress as recommended at the International Conference at Geneva are also stated. A note is given on the sixteenth congress of the National Safety Council of America held at Chicago, the object of which is defined as "the rearing of a safer generation for tomorrow." Reference is made to a bill introduced in France for increasing the powers of workers' safety delegates in mines. The appointment is announced by the German Industrial Hygiene Association of a committee to carry on a campaign against deafness caused by noises in industry. Other items noted have already received attention in THIS JOURNAL.—E. L. C.

OBJECTS AND ACTIVITIES OF INDUSTRIAL HYGIENE SECTION OF PHILIPPINE HEALTH SERVICE. *R. Villafranca and M. C. Icasiano. Philippine Islands Med. Assn. Jour., Oct., 1927, vol. 7, p. 378.*

OCCUPATIONAL DISEASES OF PRINTERS. *L. Latvscheff. Gigiena Truda, 1927, no. 3, pp. 38–43.*

More than 1,200 workers came for examination (at the dispensary) from ten of the largest printing establishments in Moscow; 88 per cent. were compositors. The author concludes: (*a*) Men employed at work with lead must be regarded as of the sympathetic-hypertonic type; (*b*) in contrast to other poisons which raise the tonus of the sympathetic system, lead brings about a decided increase in tuberculous illnesses; (*c*) lead poisoning causes disturbance of the normal correlation of the endocrine glands; (*d*) in workers who have been in this occupation for a long time an essential emphysema is observed which is due to degenerative changes in the pulmonary tissue; (*e*) the hypertonia of the sympathetic system causes secretion of gastric juice of increased acidity and richer in mineral and organic substances; (*f*) anemia and disorders of metabolism are observed more frequently in women, whose organism is less resistant to the occupational poisons than is that of men; (*g*) the majority of ill-

nesses from chronic lead poisoning concern the lungs, heart, and digestive organs.—B. A.

HEALTH CONDITIONS OF WORKERS IN THE CHEMICAL FACTORY IN BONDSHUGA. *S. Schwarz. Gigiena Truda, 1927, no. 3, pp. 44–54.*

This investigation covered 2,400 workers, of whom 804 worked directly with chemicals and 1,265 belonged to the assisting personnel.

Comparison of the different age groups of both classes of workers shows that there were few chemical workers in the group from 17 to 20 years of age and in the group over 60 but that they had a much larger percentage in the age group 31 to 60 years than had the "non-chemical" workers. The author is inclined to explain this age distribution by occupational selection.

At the same time, the workers who had directly to do with the chemicals had a higher sickness rate by one-fourth than did the assisting and executive personnel. The illnesses causing the highest rate were: respiratory affections, especially bronchitis and rhinopharyngitis; diseases of the circulatory system, especially myocarditis and enlarged veins of the leg; skin diseases; flatfoot; and conjunctivitis.

The chloracne described by several writers was not observed; the author credits this to the fact that in the factory he investigated chlorine is not obtained by electrolysis but by Weldon's method. Among the assisting personnel there was a high rate of general sickness.—B. A.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

TAR CARCINOMAS IN RABBITS. *C. Bonne. Abstr. as follows from Nederl. Tijdschr. v. Geneesk., March 12, 1927, vol. 70, p. 1318, in Arch. Dermat. and Syph., Nov., 1927, vol. 16, pp. 628–629.*

Two rabbits were each given thirteen treatments with tar on the skin of the back. In one a skin carcinoma developed, which metastasized in the lymph glands of the same side. In the other there developed an ulcerating papilloma, which was excised and on microscopic examination presented evidences of early carcinomatous degeneration. Three months later nothing abnormal was to be found in the animal. A rabbit was then treated with tar in and around the mouth, with the object of studying the effects of tar on the intestinal canal. Forty treatments were given, two a week from December to May. In June, a number of papillomas and an ulcer developed in the skin of the sacral region. Biopsy showed the ulcer to be a beginning carcinoma. Seven weeks later there were metastases in the groin. In the same animal pieces of the tumor were inserted under the skin in the neck, in the inner side of one ear and in the outer side of the other ear. Pieces of one of these grafts were inserted under the skin on the inner surface of both ears in eight rabbits that had never been tarred. In one of these animals a tumor, histologically carcinoma, developed in each ear on the site of the graft—further

attempts at grafting were unsuccessful. The tarred rabbit died about five months after the appearance of the first lesions. The gross and microscopic appearance of the lesions in this animal is described in detail.

FURTHER STUDIES ON EXPERIMENTAL TAR SARCOMA. *K. Löwenthal. Abstr. as follows from Klin. Wchnschr., 1927, no. 45, in München. med. Wchnschr., Nov. 25, 1927, vol. 74, p. 2034.*

New experiments on forty-two animals are reported. With intraperitoneal injections of tar oil the author again succeeded in producing sarcomatous tumors in mice.—M. C. S.

CHANGES IN SKIN AND ORGANS IN WHITE MICE AFTER PAINTING WITH TAR. *G. Guldberg. Abstr. as follows from Norsk. Mag. f. Laegevidensk., June, 1927, vol. 88, p. 425, in Arch. Dermat. and Syph., Nov., 1927, vol. 16, p. 629. (Abstr. also in Bull. Hyg., Jan., 1928, vol. 3, pp. 53–54.)*

The epithelial tumors that Guldberg produced in white mice by painting with tar presented a continuous series of development from papillomas with incipient infiltrating growth to fully developed carcinomas. The type of tumor appeared to depend on the duration of the painting and on the length of time that the animals survived. These growths infiltrate the skin and subcutaneous tissues and involve the blood vessels and nerves. In twenty-five mice there developed altogether one papilloma, three incipient carcinomas, and seventeen fully developed carcinomas, six of which metastasized in the lymphatic glands and lungs. The fully developed carcinomas were highly heterogenic, four of them Guldberg designates as irregular carcinomas, since they were constructed of spindle shaped cells which he regards as epithelial cells. The remaining fully developed carcinomas were all pure squamous epithelial carcinomas consisting partly of highly differentiated epithelium with abundant development of cancroid pearls, partly of slightly differentiated or entirely undifferentiated cells. In most of the pure squamous epithelial carcinomas of this series, however, there was a mixture of both differentiated and undifferentiated cell forms in varying proportions. In addition to a local effect, the painting with tar produced a general toxic effect with changes in the internal organs. In the spleen both myelogenous changes and amyloid degeneration were present. The myelogenous changes began to develop in the course of the first three or four weeks and were present in a marked degree after seventy-four days' painting with tar. Amyloid degeneration was not seen with certainty until after 250 days. In the liver there was considerable epithelial degeneration with abundant intracellular deposit of blood pigment as well as numerous lymph and leukocyte infiltrations. In all animals that lived more than 100 days, chronic interstitial nephritis was found. In most of the animals there was bronchitis, sometimes bronchopneumonia. In all the organs examined, particles of tar were found deposited in intercanalicular and intracellular spaces.

TAR EPITHELIOMA. *E. P. Lasnier. Abstr. as follows from An. de Fac. de med., Montevideo, Jan.–Feb., 1927,*

vol. 12, p. 1, in Arch. Dermat. and Syph., Jan., 1928, vol. 17, p. 118.

Of forty-two rabbits treated by Lasnier with tar, according to Itchikawa's technic, all developed tumors. Only one, however, showed clinical and histologic characteristics of malignancy. Ten rabbits of the last series now have papillomatous growths, but it remains to be seen whether the nature of the tumors will change. In many cases of alleged spontaneous cure of tar cancer, the malignancy may be apparent, not real. Scarifications cause cancerization, but only at a certain stage of the hyperkeratosis. It is difficult to determine when this special moment has arrived.

ICHTHYOSIS AND CANCER OF THE SKIN, WITH SPECIAL REFERENCE TO MULESPINNERS' CANCER. *L. Savatard. Abstr. as follows from Proc. Roy. Soc. Med., Aug., 1927, vol. 20, pp. 1589–1596 (Dermat., pp. 93–100), and Brit. Jour. Dermat. and Syph., 1927, vol. 39, pp. 399–405, in Bull. Hyg., Jan., 1928, vol. 3, pp. 49–50.*

In all cases of cancer of the skin the author invariably examines the whole skin surface for evidence of ichthyosis, having found that both squamous celled and basal celled carcinomas not infrequently arise on keratoses in ichthyotics, and that multiple lesions are sometimes present. He regards as simple ichthyosis the so-called "shagreen" skin said to be found in mule spinners. In an examination of 400 mule spinners he found ichthyosis present in twenty and he believes that the great majority of mule spinners who develop what is regarded as an occupational cancer (carcinoma of the scrotum) can be shown to have an ichthyotic skin, on which cancer would be prone to arise irrespective of the patients' occupation.

In the discussion which followed, the speakers expressed interest in the opinions put forward regarding ichthyosis, but considered that other conditions, notably senile keratosis, were more certainly precancerous. As to the view that the action of mineral oils, tar, soot, and other reputed carcinogenic agents was not the sole determining factor in the development of scrotal cancer, it was suggested that it would be simple to ascertain the number of cases occurring in people whose occupation did not bring them into contact with these substances.

[The census of 1921 shows a total of 57,069 cotton spinners of all classes, about 23,000 being mule spinners, almost all males. The Registrar-General's Report for 1923 records 64 deaths from cancer of the scrotum; 15 of these occurred in cotton spinners and 4 in sweeps, the remaining 45 cases being furnished by all other occupations in the entire male population of England and Wales (see Kennaway, "The Anatomical Distribution of the Occupational Cancers," THIS JOUR., 1925, vol. 7, p. 69.]

THE INCIDENCE OF INTRATHORACIC TUMOURS IN MANCHESTER. *J. B. Duguid. Lancet, July 16, 1927, vol. 2, pp. 111–116.*

The postmortem records of the Manchester Royal Infirmary were analyzed; in 1886 to 1890 intrathoracic tumors formed 1.58 per cent. of all postmortems, and in 1891 to 1895 the percentage was 1.28; but by 1916 to 1920 it had risen to 2.42

and by 1921 to 1925 to 2.57. Such cases seem to be increasing relatively and absolutely. Out of 175 cases, 151, or 86.3 per cent., occurred among men, and only 24, or 13.7 per cent., among women. The occupation was traced in 143 male cases; although no particular industry was located as specifically dangerous, outdoor workers, such as carters, claimed more than those employed under sheltered conditions. The possibility of road dust playing a part is suggested, on the analogy of the Schneeberg miners; modern road dust contains tar, while the atmosphere is polluted by motor exhaust gases. The evidence gathered, while inconclusive, is interesting. The paper contains six clear microphotographs of tumor sections which are well described.—E. L. C.

CIRCULATORY SYSTEM

DEALING WITH THE CARDIAC PATIENT IN INDUSTRY. *G. H. Britton and S. P. Moore. Nation's Health, Sept., 1927, vol. 9, pp. 18–20, 74.*

The authors discuss the program of the Chicago Heart Association, a description of which has already appeared in THIS JOURNAL in an article by Mock and Moore (1927, vol. 9, p. 176).

RESULTS OF BLOOD EXAMINATIONS OF WORKERS IN THE COPPER ROLLING MILL OF THE SUPREME POLITICAL ECONOMY BOARD OF GEORGIA. *E. Semenskaja. Gigiena Truda, 1927, no. 2, pp. 43–46.*

From blood examinations of twenty-two workers in the copper rolling mill the author reaches the following conclusions:

a. The insignificant changes in the erythropoietic and myelopoietic systems cannot be traced to poisoning of the organism by copper.

b. Alterations in the erythrocytes can be fully explained by incidental illnesses and known conditions of work.

c. Alterations in the leukocytes are brought about by long-continued fatigue (toward the end of the working season).—B. A.

OBSERVATIONS ON THE BLOOD PRESSURE OF WORKERS EMPLOYED IN CHEMICAL PLANTS. *A. Kulagin. Gigiena Truda, 1927, no. 2, pp. 46–51.*

Observations concerning the effect on the organism and especially on the blood pressure of single days of work and of separate processes were made on workers at sulphate ovens and in chlorine chambers of a chlorine factory and on workers at smelting furnaces of a sodium sulphide factory. In most cases at the close of work lowered systolic blood pressure which persisted for from thirty to forty minutes was observed. Following heavy work the diminution in blood pressure was greater and the return to normal more retarded.

The diastolic pressure showed only insignificant fluctuations.

The pulse rate was accelerated in most cases; the heavier the work, the greater was the acceleration and the slower the return to normal. Not only physical strain but also thermal, photogenic, and chemical factors (hydrochloric acid, chlorine, hydrogen sulphide, and possibly carbon monoxide) made the work difficult.—B. A.

NEUROMUSCULAR SYSTEM

CARPENTER'S HAND. *Billich. München. med. Wchnschr., Nov. 11, 1927, vol. 74, p. 1941.*

From clinical and X-ray examinations of the hands of 200 carpenters and builders, Billich draws the following conclusions: After several years of work, in 40 per cent. of the cases there is a moderate degree, in half of these a considerable degree (amounting to from 25 to 40°), of ulnar deviation of the four ulnar fingers. All subjects in whom there was the slightest suspicion of joint disease were eliminated from the study. The deviation is not caused by pathologic processes but purely through mechanical effect from grasping the chisel and the saw and particularly from the lateral pressure of the plane. An exaggeration of the position present in a slight degree in the normal hand is thus brought about. An ulnar deviation of the index finger amounting to 20° is still normal.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

SPRAY PAINTING IN PENNSYLVANIA. *Pa. Dept. Labor and Industry, Special Bull. No. 16, 1926, pp. 201.*

This bulletin is divided into the following parts: (1) "Findings in Plants and Industries Surveyed" (pp. 11–52). This section was written by Dr. Henry Field Smyth, and is made up of short notes on the plants visited. (2) "Report to Advisory Committee of Study of Spray Painting" (pp. 53–144; 145–192). Part I of this report was also written by Dr. Smyth. Part II was written by Dr. Edwin F. Pike and Henry Field Smyth, Jr. (3) Report on "The Effect of Butyl and Amyl Acetate Vapor on Guinea Pigs" (pp. 193–196) was written by Alice T. Marston and Raymond S. Patterson, who conducted this study.

The results of the investigation are summarized as follows:

1. The purpose of the study was to determine whether there is a health hazard involved in the coating of surfaces with paint, varnish, lacquer, shellac, enamel, and similar materials by the spray method; and if such hazard is present, in what manner it is manifested and to what extent.

2. In the field survey 233 establishments were visited; 383 physical examinations were made; 168 air velocity measurements were taken; and air was sampled and determinations made for the presence of benzol (91 samples), total solvents (10 samples), lead (22 samples), and dust particles (26 samples).

3. No cases of marked ill health which could be attributed to the work of the individual examined, were found, although some histories to this effect were obtained.

Mild symptoms of benzol absorption were found in persons spraying lacquer, substitute shellac, and stain. Blood examinations showed specific changes, which, while not so far advanced as to produce definite symptoms, were of such character as to indicate the absorption of benzol in its early stages.

Evidences of slight lead absorption were found in some sprayers of lead, but no cases of acute lead poisoning were met.

In the sprayers of vitreous enamel and other siliceous materials, X-ray photographs of the chest showed, in a few instances, definite fibrosis, and in others, lesions suggestive of beginning fibrosis;

these two groups comprising not quite one-third of the total number examined.

4. Exhaust ventilation was studied through laboratory determinations. In these, a commercial booth was used for the spraying of objects of dissimilar sizes and shapes with material of different but known benzol content under varying conditions.

5. The health hazards encountered in spray coating processes may be overcome by the use of materials of nontoxic and nonirritating character, by the use of materials in which these elements are reduced to a minimum, and by requiring that when the spraying process is used certain definite precautions must be observed. With this in mind the Department of Labor and Industry has formulated tentative regulations covering this subject which will be discussed at public hearings and which will then form the basis of the regulations adopted and enforced by the Department.

6. As the composition of lacquers has not yet been standardized and as almost all lacquer makers are continually changing their formulae and attempting to use entirely new solvents, the effect of which upon the health is or may be unknown, we feel that the indicated precautions will be advisable even though benzol itself may be entirely eliminated.

In discussing the relation between velocities of air at the spray booths and concentration of benzol, the authors state:

. . . . With velocities of over 150 feet per minute the benzol content of the air never exceeded 200 p.p.m., except in two instances, one of which was with a lacquer that was stated by the manufacturer to contain 40 per cent of benzol.

. . . . We would recommend that except possibly for use in purely automatic spray cabinets where the spraying is done at a point considerably removed from a small feed opening, no spraying lacquer, paint, nor stain, etc. should contain over 5 per cent of benzol by volume. Where box or cabinet interiors are to be sprayed, lacquers should contain decidedly less benzol than this. In fact it would be safer to put a 5 per cent benzol limit on all spraying lacquers. . . . . Exhaust ventilation to be adequate should produce air currents past the sprayer into the booth of at least 125 feet per minute or preferably 150 feet per minute measured at the working face of the booth, and the pull should be fairly evenly distributed over the face of the booth.

The field studies and the laboratory work are given in great detail with copious tables, curves, diagrams, and charts.—P. D.

QUALITATIVE BLOOD CHANGES IN POISONING BY CARBON MONOXIDE, LYSOL, AND ANILINE OIL. *Arneth and Albacht. Zentralbl. f. Gewerbehyg., July, 1927, N. S. vol. 4, pp. 225–228.*

The literature shows that studies of the blood in the foregoing intoxications have been almost always quantitative, not qualitative. The following three cases have been studied with the latter point in view.

Case 1, carbon monoxide poisoning, was examined early, before pneumonia set in. A marked loss of red cells was noted, the erythrocyte count being 2,784,000, with hemoglobin 68 per cent.; the white cells numbered 14,800, with a marked "displacement toward the left"[1] of the neutrophils, 42 per cent. being in Class 1 (Arneth); eosinophils and mast cells had disappeared; the mononuclears were practically normal.

Case 2, suicidal lysol poisoning, with gastric hemorrhage, showed an even greater loss of red cells, one and a half hours before death the erythrocyte count being 2,280,000. The leukocyte count was 23,200, in which the neutrophils predominated with 35 per cent. in Class 1; eosinophils and mast

[1] Arneth's phrase for the displacement of cells with 3, 4, and 5 nuclei by cells with 1 or 2, Class 1.

cells were absent, but there was an increase of lymphocytes both large and small.

Case 3, acute aniline poisoning with cyanosis, air hunger, palpitation of the heart, headache, etc., showed on admission to the hospital hemoglobin 65 per cent., red cells 3,925,000, leukocytes 9,500. The chief change was in the red cell count which did not reach normal for three weeks. The white cells showed only a slight increase; there was no qualitative change and no disappearance of eosinophils or mast cells.—A. H.

THE OCCURRENCE OF POISONING AMONG MEN EMPLOYED IN WORKING EBONITES. *M. Bastian. Arch. de méd. et pharm. nav., 1927, vol. 117, pp. 307–315.*

The processes of sawing and turning ebonite generate dust if the material is brittle. Dust from two such ebonites when inhaled caused symptoms of nausea, vomiting, headache, vertigo, constipation, and colic. One sample which was worse than the other was found, when heated, to evolve trace of seleniuretted hydrogen; both samples evolved sulphuretted hydrogen which came off at a lower temperature than in the case of a third ebonite which was considered by the men as inoffensive, and gave rise to but little dust. After incineration the offensive ebonites gave some 40 per cent. ash which contained lead. Mercaptols were also detected; they, with lead, are often used as accelerators when vulcanizing rubber, in the manufacture of ebonite. The composition of the offensive ebonites was considered amply sufficient to account for the symptoms experienced.—E. L. C.

THE CLINICAL PICTURE OF CHRONIC LEAD POISONING. *G. Thoma. Zentralbl. f. Gewerbehyg., June, 1927, N. S. vol. 4, pp. 212–215.*

This is a review of the clinical picture of acute lead poisoning and of the varied manifestations of the chronic form which may present many difficulties to the diagnostician. The history of exposure to lead is of great assistance and in the larger number of cases it will be found that the onset of illness has been characteristically insidious with symptoms of a neurasthenic or endocrinal character rather than those of plumbism. This vague and varied picture together with the lead line, stippled cells, attacks of colic and arthritis, with changes in the kidney, make up the characteristic picture. The treatment recommended is the intravenous administration of sodium thiosulphate, which, according to the author, originated in the United States and is now replacing all former methods in American therapeutic practice.—A. H.

LEAD POISONING: IV. EFFECT OF LEAD ON THE NEUROMUSCULAR APPARATUS OF THE FROG. *A. Breitburg and L. Radtschenko. Gigiena Truda, 1927, no. 3, pp. 3–22.*

This investigation was undertaken to discover the effect of lead (*a*) on the sensitivity and conductivity of the nerve trunk and (*b*) on the contractility of the transversely striated muscle.

According to the authors' conclusions, which deny the possibility of a primary effect on the nerves and muscles through direct contact with solutions of lead, the neuritic and myopathic theories are significantly

weakened, and the supposition of the partisans of the spinal cord and vascular theory is strengthened, according to which the fatigued muscles are the locus minoris resistentiae where, more than anywhere else, the secondary processes develop.—B. A.

THE FATE OF COLLOIDAL LEAD COMPOUNDS AFTER INTRAVENOUS INJECTION. *F. Bischoff, N. R. Blatherwick, and E. Hill. Jour. Pharmacol. and Exper. Therap., July, 1927, vol. 31, Proc., pp. 222–223.*

"Intravenous injection into rabbits of colloidal metallic lead, colloidal lead oxide, ionic lead, colloidal lead phosphate, ionic lead in blood serum, ionic lead in red cells, and colloidal lead carbonate were made. The results showed that the colloidal lead phosphate and the ionic lead which had been added to serum were nontoxic. The colloidal lead oxide, colloidal lead, lead-red cell reaction product, and ionic lead acetate had the same degrees of toxicity. The results indicated clearly that the form of lead which is toxic is some other reaction product than the phosphate and that it is formed when the lead ions are added to the blood stream."

Colloidal lead phosphate was shown to be destructive to cancer tissue and patients have a greater tolerance for this compound than for metallic lead. The toxic action of the phosphate is delayed but is evidenced later by stippling and decrease in hemoglobin. The distribution of lead in the postmortem tissues of patients treated with colloidal lead was determined and the amount of lead excretion of patients treated with colloidal lead phosphate was studied.—L. T. F.

AN IMPROVED METHOD FOR ANALYZING THE AIR OF MINES BY DETERMINATION OF METHANE AND CARBON DIOXIDE. *E. Selivanoff. Gigiena Truda, no. 3, pp. 34–37.*

This improved method for determination of methane and carbon dioxide in mine air consists, first, in absorbing the substances, then in combustion of the methane to carbon dioxide in Dreschmidt's capillary tubes, and, finally, in absorption of the carbon dioxide with barium hydroxide solution followed by titration with oxalic acid. Absorption and titration of carbon dioxide takes place in a special apparatus which guards against any effect of the air in the room on the barium hydroxide solution.—B. A.

SOME OBSERVATIONS UPON THE PHARMACOLOGY OF TIN. *E. W. Schwartze and W. F. Clarke. Jour. Pharmacol. and Exper. Therap., July, 1927, vol. 31, Proc., pp. 224–225.*

Feeding experiments in which tin was added to food either as the result of normal corrosion of the metal in food or as tin chloride (both stannous and stannic) were made using guinea-pigs as subjects. Cats were fed canned sardines containing 222 parts per million of tin and the tissues analyzed for tin. After receiving 1.2 to 2.2 gm. of tin over a period of from three to seven months, the analyses showed the spleen, liver, kidneys, muscle, heart, skin, blood, and lungs to be tin free.

Four human subjects fed tin contaminated food showed a urinary excretion of no more than 0.4 mg. of tin oxide over a period of five days although the amount ingested varied from 2 to 2.75 gm.—L. T. F.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

IRRITATION OF THE EYES AND MUCOUS MEMBRANES DUE TO EXHALATIONS FROM MORELS (GROUP INDUSTRIAL POISONING). *Pick. Abstr. from Ztschr. f. Augenh., 1927, vol. 61, pp. 325–332, in München. med. Wchnschr., Sept. 30, 1927, vol. 74, p. 1686; abstr. from Deutsch. med. Wchnschr., 1927, no. 37, in München. med. Wchnschr., Oct. 7, 1927, p. 1729.*

Of forty-eight women employed in a preserving factory, picking over, washing, and cooking morels, twenty-two became ill with photophobia, disturbances of vision and pain in the eyes, cough, loss of appetite, vomiting, and in some cases with jaundice and fever also. The eye irritation consisted chiefly in an epithelial keratitis, with reduction of visual acuity to one-fourth and less. These disturbances were traced to the foam from the helvellic acid in the morels, which is spattered about while they are being scoured and washed in cold water. The accompanying pharyngitis, laryngitis, and bronchitis, as well as the gastric and hepatic symptoms, are ascribed to the same cause. Recovery followed symptomatic treatment.—M. C. S.

EYE INJURIES IN WORKERS IN SULPHUR BATH ESTABLISHMENTS. *P. F. Archangelsky. Abstr. as follows from Klin. Monatsbl. f. Augenh., Jan., 1927, vol. 78, pp. 64–68, in München. med. Wchnschr., Oct. 7, 1927, vol. 74, p. 1730.*

On the Russian shore of the Black Sea, in the vicinity of Sotschi, are located the Mazeta sulphur springs the hydrogen sulphide content of which is 100 times greater than that of the springs at Aix-la-Chapelle. The air in the bathing establishments contains 0.06 to 0.1 mg. of hydrogen sulphide per liter and causes severe irritation of the nasal mucous membrane and of the conjunctiva, as well as violent headaches. Lacrimation, photophobia, and hyperemia of the conjunctiva and of the fundus are present about four hours after leaving the establishment. In the fundus, besides the hyperemia of the retinal vessels, there is hyperemia of the papilla, the borders of which seem very indistinct. The field of vision shows a slight contraction of the outer limits. Apparently the ocular symptoms are due to the penetration of the hydrogen sulphide fumes through the nose and its accessory cavities. The workers should be protected against the effects of the gas by wearing gas masks.—M. C. S.

ARGYROSIS OF THE CORNEA IN INDUSTRIAL DISEASES. *K. Steindorff. Abstr. as follows from Klin. Monatsbl. f. Augenh., Jan., 1927, vol. 78, p. 51, in Am. Jour. Ophth., Feb., 1928, vol. 11, p. 176.*

A man aged 80 years, who for fifty years had worked in a factory for silver "filling" of metals by galvanizing process, presented ocular argyrosis. There was a brownish black staining in the vicinity of the semilunar fold. The cornea appeared uniformly slightly gray, the gray color appearing under the Zeiss loupe as dots of silvery luster in the deeper layers as far as Descemet's membrane. The posterior surface seemed opaque,

but the fundus was clearly visible. That the silver particles were especially accumulated near Descemet's membrane is in accordance with the fact that in argyrosis elastic tissue is intensely colored by silver.

Argyrosis can be explained mechanically by dispersion of insoluble metallic silver in finest suspension through the blood and sedimentation in certain tissues. Or we may assume that the silver particles conveyed into the stomach are converted into silver chloride, and that in the presence of albumin this is transformed into silver albuminates which are dissolved in the digestive juices, conveyed by the blood current, and partly reduced in the intestines, liver, kidney, and skin.

THE FIRST AID TREATMENT OF CHEMICAL BURNS OF THE EYE. *K. W. Cosgrove. Safety Engin., Dec., 1927, vol. 54, pp. 214–216.*

The author reports experiments on rats and rabbits made for the purpose of studying the effects of various methods of treatment in burns of the eye due to sulphuric acid, nitric acid, phenol, sodium hydroxide, lye, ammonium hydroxide, lime, and metallic salts. He concludes that, regardless of the concentration of a chemical, or of the time interval, the best result is obtained with irrigation; that neutralization definitely causes damage; that the mechanical removal of the chemical is the most important factor; and that after a certain time of exposure for any concentration irreparable damage has been done, consequently it is of utmost importance that first aid be rendered as promptly as possible.—M. C. S.

CHEMICAL BURNS OF THE EYE. *H. Villard. Arch. d'opht., 1927, vol. 44, pp. 222–234.*

GLASS BLOWERS' CATARACT AS AN OCCUPATIONAL DISEASE. *E. Stoewer. Abstr. as follows from Klin. Monatsbl. f. Augenh., Aug., 1927, vol. 79, p. 243, in Am. Jour. Ophth., Feb., 1928, vol. 11, p. 160.*

By means of the slit lamp and ophthalmoscope Stoewer examined about 2,000 laborers occupied at glass blowing furnaces. In young workers, during the first few years of occupation in the glass industry, no lesion visible in the lens is produced. Up to the forty-fifth year occupational opacities of the lens are rarely encountered, but the lens passes through a prematurely senile process, which may manifest itself in premature presbyopia. In the sixth and seventh decades of life typical lens opacities, or detachment of the anterior capsular lamellae, due to exposure to the furnace, are found in the majority of the laborers, but only a small percentage of those who begin there reach this age at the glass works. The lesion does not necessarily always cause impairment of vision or inability to work. Corresponding to the frequency at different periods of life is the occupational age of those affected. Up to the twentieth occupational year no effect was noted, to the thirtieth year slight lesions, and subsequent increase with the number of occupational years to 90 per cent. of involvement.

DANGERS OF ERRONEOUS EXAMINATIONS OF WORKER'S EYES. *D. J. Kindel. Nation's Health, Sept., 1927, vol. 9, p. 33.*

The Ohio State Department of Health had occasion to investigate the nature and extent of eye examinations being conducted in a shoe factory by a firm of optometrists. On the basis of the findings, Dr. Kindel stresses the importance of having eye examinations carried on by a recognized doctor of medicine who has specialized in ophthalmology. "Unless thorough understanding of the work to be done is obtained by the contracting company, possibility of employee exploitation is always present."—E. D.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

INCIDENTAL COST OF ACCIDENTS TO THE EMPLOYER. *H. W. Heinrich. U. S. Month. Labor Rev., Aug., 1927, vol. 25, pp. 270–274.*

The author describes as "incidental costs" the secondary or noninsurable losses due to accidents, as distinguished from the insurable losses such as compensation or liability claims, plus the charges for medical attention. An analysis of 5,000 specific accident reports, drawn at random from the files of the Travelers Insurance Company, shows that the incidental accident cost, paid by the employer directly, is four times the total cost represented by compensation and liability claims and medical treatment. There may be some variation in this figure when the facts come to be computed on a national basis; nevertheless, as one employer recently stated: "It may not be 4 to 1, but I can see that it is something to one, and whatever it is, it is too much." The author gives an itemized list of the main factors to be considered in calculating these incidental costs, in which he includes "the more obvious factors that are subject to measurement and that are . . . . quite sufficient to prove the point that accident prevention is well worth a place in plant routine, and that it should be dealt with just as definitely and intelligently as other items of so-called overhead expense."

Examples are given which demonstrate that a substantial cost to the employer often results from trivial accidents that are not compensable and that do not require expert medical attention.—M. C. S.

IMPROVEMENTS IN THE SPHERE OF PLANT SANITATION AND OF ACCIDENT PREVENTION IN THE R. S. F. S. R. IN 1925. *B. Markus. Gigiena Truda, 1927, no. 2, pp. 70–75.*

The data cover all large manufacturing plants situated in the R. S. F. S. R. territory (enterprises with 250 and more workers). Measures for protection of labor are included costing 25 million rubles and, in addition, plant improvements which have indirectly to do with labor protection (such as erection of plant buildings and dwellings, arrangement and supply of central heating, isolation of electric conductors, mechanization of freight transportation, etc.), to the extent of 74 million rubles. On an average, 16.1 rubles per worker (or about 3 per cent. of his pay) went to expenditures directly connected with his protection, and 47 rubles (or about 9 per cent.) to expenditures having an indirect connection. Thirty per cent. of all expenditures were for sanitary (hygienic) measures, about 30 per cent. for

technical expenses, and 40 per cent. for accident prevention.—B. A.

Occupational Injuries in the Moscow Government in 1925. *M. Sarch. Gigiena Truda, 1927, no. 2, pp. 76–85.*

The author uses data on trauma contained in the sickness records of those insured. Woodworking was responsible for the highest record of traumatism, the lowest records being shown by the tobacco factories and by the printing and the textile industries. Accidents involving loss of work for three days amounted to 13.9 per cent.; for over three days, to 86.1 per cent. The apparent increase in occupational injuries, as compared with those of the prewar period, must be laid to the modern more complete registration of fatal accidents.

The younger, less skilled workers were responsible for the largest number of injuries, while the number of fatal injuries declined with the age of the workers.

Analysis of accidents according to the day of the week on which they occurred showed two peaks, on Tuesday and on Friday.

The largest number of accidents (31.7 per cent.) happened at work with machines; work with hand tools and with simple devices claimed 20.3 per cent. and lifting and moving objects, 17.4 per cent. of fatal accidents.

Most of the fatal accidents were due to different kinds of wounds (especially incisions) and the fatal injuries to knocking against things. These two groups comprised 73.5 per cent. of all fatalities.—B. A.

Traumatic Injuries of the Foot as Related to Bituminous Coal Mining. *W. E. Dodd. Atlantic Med. Jour., April, 1927.*

Analysis of 1,000 accidents occurring in mines showed that 11 per cent. involved the foot proper, and 8 per cent. the leg and ankle. Of the total accidents to the foot, 2.5 per cent. were fractures and 8.5 per cent. lacerations, puncture wounds (usually inflicted by the point of a pick), and contusions which ranged from slight bruises to severe crushing injuries. The author describes his treatment of uncomplicated lacerations, of cases in which infection occurs, and of severe contusions and crushing.—M. C. S.

Vision in Relation to Industry. *E. M. Neher. Calif. and West. Med., Nov., 1927, vol. 27, p. 638.*

Methods for accomplishing conservation of vision should, in the author's opinion, include legislation, vision testing and proper correction of defects, protection of eyes against injuries, and education. He believes that legislation that is fair to both employee and employer can be accomplished best by establishing an industrial commission invested with full power to require the necessary accident reports, to make and enforce safety measures, and to administer equitable compensation.

The absence of proper eye protection in industries is shown by the great number of eye accidents reported. The National Safety Council estimates 250,000 eye injuries annually. In California, during the four years 1917 to 1921, of 9,328 permanent injuries reported 13 per cent. involved the eyes. The American Foundry Association reports that 20 per cent. of all nonfatal accidents occurring in foundries are eye injuries. Speaking

from the point of view of his own state, the author says that "There are far too many eye accidents in the industries of Utah. In both the metal and coal mines we find the men especially adverse to wearing goggles, stating that perspiration and air currents cause the lenses to fog. These and other objections can be overcome by using the correct type, by wearing a sweat-absorbing band around the forehead, and coating the lenses with one of the various substances used to prevent the glass from fogging. The use of the proper eye-protective devices by the employees of Utah would reduce eye injuries 90 per cent."

Great possibilities for elimination of the destruction of vision lie in education. The state should be educated to realize its humanitarian and economic obligation by establishing and enforcing adequate safety first measures; the management of industries should be educated in the economic value of eyesight conservation; and employees should be educated in the observance of safety measures.—E. D.

INDUSTRIAL SURGERY

THE MANAGEMENT OF HAND INFECTIONS. *H. H. Le Seur. Am. Jour. Surg., Jan., 1927, N. S. vol. 2, pp. 38–41.*

This is a brief and extremely meaty review of the practical methods to be used in managing affections of the hand. Dr. Le Seur begins with the tips of the fingers and carries his observations through the entire hand. The article itself is practically a summary and cannot be abbreviated.

The author's conclusions are as follows:

1. Infections of the hand challenge our most careful attention because of their number, and their importance in decreasing the earning power of the employee.
2. The smallest wounds may be the most disastrous.
3. Anatomical information, bloodless field, sharp scalpel, good light, patience and a general anesthesia are essentials.
4. Never forget tetanus antitoxin.

A brief but useful bibliography is appended.—C. K. D.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

RESUSCITATION BY ARTIFICIAL RESPIRATION. *O. Bruns. Abstr. as follows from Klin. Wchnschr., 1927, no. 33, in München. med. Wchnschr., Sept. 9, 1927, vol. 74, p. 1566. See also abstract in Physiol. Abstr., Feb., 1928, vol. 12, p. 624.*

The author made a study of the various manual and instrumental methods of respiration with regard to the possibility of establishing temporary circulation in fresh cadavers and in dogs, the amount of ventilation and the blood pressure attainable, the transportation of staining solutions in the vascular system, and the incorporation of oxygen in the blood by these methods. The results of the study are given in detail. No form of respiration was found to bring about

a real circulation of the blood. It is recommended that artificial respiration be combined with the use of oxygen. The procedure in artificial respiration is described and the Silvester method is mentioned as possessing special advantages.—M. C. S.

WEIGHTS AND HEIGHTS OF THE MINE EMPLOYEES OF THE WESTERN AUSTRALIAN GOLDFIELDS. *B. H. H. Hooker. Health, Commonwealth of Australia, Nov., 1927, vol. 5, pp. 172–182.*

Physical data were collected regarding heights and weights of 4,144 men. They are set out in well-prepared tables according to nationality and age. Australian born and Slavs had an average height of 5 feet, 7.1 inches, British of 5 feet, 6.4 inches, and Italians of 5 feet, 5.3 inches. Slavs and Italians had an average weight of 153 pounds; Australians and British of 146 pounds. Workers whose lungs were affected from exposure to dust were found to be lighter in weight in proportion to the amount of disease; the average weight for workers with fibrosis was 6 pounds less than that for normal workers, for those with early silicosis 7 pounds less, with advanced silicosis 10 pounds less, with silicosis and tuberculosis 19 pounds less, and with tuberculosis only 22 pounds less.—E. L. C.

VARIABILITY OF PERFORMANCE IN THE CURVE OF WORK. *J. D. Weinland. Arch. Psychol., May, 1927, no. 87, pp. 68.*

In the introduction the author states:

"Four kinds of variability in the curve of work may be discerned; namely,

"1. Variation of performance at different stages of the work curve;"

"2. Variation of performance among different work curves, made under the same conditions;

"3. Variation among individual muscular contractions;

"4. Variation of performance in the course of training.

The study is presented in five chapters, one for each of the foregoing problems and a final one in which general conclusions are given as follows:

1. Relative variability of output increases with fatigue. This is found true in Chapter I, Part One, for total variability which includes the fall in the curve; in Chapter I, Part Two, it is found true for incidental variations; in Chapter III the relative variability of several curves from an average curve is found to increase constantly with fatigue.

2. Variability of performance in beginning work can be affected by any one of a number of causes: the fact of having done previous work, the length of the ensuing rest period, the rhythm of work, the load, etc. It seems possible that variability might be made a measure of the effect of any one of these factors, by keeping all the others constant. Chapter I.

3. The variability curve for output in any one period is determined somewhat by the weight pulled. Chapter I. The deviations of several curves at different points in those curves are very definitely affected by the weights pulled. Chapter III.

4. Individual differences in variability are both striking and important. These are found in comparing different parts of the individual work curves, and in comparing different work periods. Chapters I and IV.

5. Individual differences appear to be greatest at the low output end of the work curve.

6. The increase of variability with

fatigue is due rather to a loss of control than directly to the exhaustion of muscle.

7. Deviations among several work curves at different points in those curves are greater toward the low output end of the curves, but less again near the exhaustion point. Chapter III.

8. Difficulty in keeping time to a metronome increases with continued work. The tendency is to lose time. Chapter III.

9. The amount of time expended on work in the individual strokes is proportional to the amount of work done as measured by length of stroke. As work goes on the subject spends less time in working even though keeping time to a metronome; his rest each second is longer, his stroke "smaller" in every respect. Chapter III.

10. The contraction time of individual strokes is less than the relaxation time. Chapter III.

11. Subjects do not always learn, with practice, to work in the most efficient way. This may be due to (a) a closer following of directions, such as those given in this experiment, that lead to more intensive but less efficient work; or (b) a gradual adjustment to a more congenial effort.

12. If the date for finishing the experiment is known to the subjects they tend to do more work in the last few workspells than in the preceding ones. Chapter IV.

13. The degree of variability within the work curve appears to remain comparatively constant for a given individual, under particular working conditions. Chapter IV.

A bibliography of forty references is included.—B. A.

IMPROVEMENT OF WORK FURNITURE IN THE SORTING DEPARTMENT OF A TOBACCO FACTORY. *W. Iljinsky. Gigiena Truda, 1927, no. 2, pp. 56–61.*

In the sorting department of a tobacco factory the worktables and seats were replaced by new furniture which enables the worker to sit erect all the time or, if she becomes tired in this position, to lean on the seat; during work the feet can be stretched out in front or crossed under the seat. The table has several improvements. Experiments were made comparing working capacity and fatigability in workers when using the old furniture and when using the new. It was shown that the average production of two tobacco sorters working at the new furniture surpassed that at the old by 18 per cent. Dynamometric data showed an increase of 5.6 per cent. in comparison with data on work at the old furniture; and a reduction of heart palpitation, a quieter respiration on the part of the women workers, and an increase in the vital capacity of the lungs were observed.—B. A.

FURTHER EXPERIMENTS ON THE INFLUENCE OF MENTAL ACTIVITY UPON THE RESPIRATORY AND ENERGY EXCHANGE. *G. W. Chlopin, W. Jakowenko, and W. Wolschinsky. Arch. f. Hyg., 1927, vol. 98, no. 4–5, pp. 158–175.*

This experimental evidence throws considerable light upon the controversial subject of mental work and energy expenditure. According to the data presented, mental work does involve a certain amount of energy expenditure, but this amount depends, to a large extent, on the type and intensity of mental activity pursued.

Mental work such as that involved in learning foreign words has the smallest influence on the oxygen consumption (0.8 per cent.) and on the gaseous exchange (8.8 per cent.). This slight influence was noticed on one subject only. Lectures and examinations, on the other hand, caused a very significant increase. In addition to increase in oxygen consump-

tion, carbon dioxide production, and gaseous exchange, the pulse rate, rate of respiration, and respiratory quotient also increased. Table 1 summarizes the influence of type and grade of mental activity on the energy requirements.

TABLE 1

MENTAL ACTIVITY	OXYGEN CONSUMPTION	CARBON DIOXIDE PRODUCTION	GASEOUS EXCHANGE
	%	%	%
Learning foreign words	+0.8	−0.5	+8.8
Reading scientific books	+7.5	+4.3	+11.9
Mental arithmetic computations	+18.6	+17.0	+25.2
Lectures and examinations	+14.0	+22.2	+25.3

Using these data as a basis, the authors explain, quite plainly, the discrepancies in the results of previous investigators, attributing the differences to improper choice of type and grade of mental work and to wrong technic. It is pointed out that the type of mental work best suited for studying changes in energy requirements in short experiments is mental arithmetic, because it is less subject to variations and individual fluctuations than is any of the other methods. —C. P. Y.

WORK AND FATIGUE. *E. Atzler, H. Betke, G. Lehmann, E. Sachsenberg, et al. Abstr. from Beihefte z. Zentralbl. f. Gewerbehyg., 1927, no. 7, pp. 91, in Bull. Hyg., Jan., 1928, vol. 3, pp. 85–86.*

In this interesting symposium Dr. E. Atzler contributes an article on the physiology of fatigue in which reference is made to the ergograph. Dr. G. Lehmann describes various methods of ascertaining the demands made upon man by work, among which Benedict's respiration apparatus and Gilbreth's methods of attaching electric lights to moving parts of the body are described. Dr. H. Betke contributes a long article dealing with fatigue and recovery, and the physiologic factors that help to determine it. The article is an extremely good summary of the various factors connected with fatigue but it covers too wide a field to deal with any of the various questions in detail. It would have been better if references to original work had been more freely given so that the student could have gone more deeply into the various problems involved. Dr. E. Sachsenberg describes certain methods that have been employed with the object of measuring fatigue. Among these are changes in the composition of the blood, changes in pulse rate, the esthesiometer, together with certain performance tests. Among the shorter contributions Dr. L. Ascher's on movement study is well illustrated and has the advantage of presenting new work.

THE TOLL OF INDUSTRIAL NOISE. *C. F. Faulkner. Abstr. from Factory, June, 1927, in U. S. Month. Labor Rev., Aug., 1927, vol. 25, pp. 280–281.*

The author discusses the effects on the human system of various kinds of noise met with in industrial employment and some of the methods by which noise and vibration may be eliminated. The reason that the bad effects of loud and continuous noise

have not been more generally recognized, he believes, is because the effects are both insidious and cumulative in their action. "It has been proved that loud and continuous noise lessens the ability to concentrate, to follow a consistent line of thought, or to meet emergencies where quick, coherent thinking is required. Aggravate this condition with exposure to direct vibration and you have a possible explanation of some of those seemingly needless accidents that one encounters so frequently."

In conclusion the writer says:

> This problem of noise prevention can be solved only by scientific research. We must learn what types and conditions of men are physically unfitted to withstand continuous noise. We must have more definite standards for measuring different noise effects on human fatigue and health and how to offset or eliminate them. The duty of removing this nuisance rests on industry. Since it has been found that noise has a direct relation to human fatigue any activity directed to this end should prove very profitable.

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

REPORT ON A COMPRESSED AIR EXPLOSION WHICH OCCURRED ON JANUARY 7TH 1927, AT A SHAFT SUNK BY THE FOUNDATION CO. LTD., AGENTS FOR THE LONDON POWER CO. LTD., AT DEPTFORD GREEN. *R. U. Shaxby and L. C. McNair. Home Office Rep. No. 1853. H. M. Stationery Office, 1927.*

While a pit 20 feet in diameter was being excavated and lined with cast-iron tubbing by the underpinning method, the steel deck, capping the shaft, was blown off and five or six men inside the shaft were killed. The pressure within the shaft at the time was not more than 13 pounds per square inch above atmosphere and the cause of the failure was ascertained only after close investigation of all the circumstances by two of His Majesty's Inspectors of Factories.

Their Report deals with the many possible causes suspected of originating this disaster, such as an explosion of oil from compressors, of methane, of hydrogen, or of bombs dropped during the war. All of these seemed, at first, more likely to account for what happened than the ascertained cause, namely, mechanical weakness in the apparently strong design of the structure which was discovered upon expert examination.

It was found that the attachment of the steel deck to the cast-iron shell, lining the pit, through the flanges usual on cast-iron tubbing, set up unexpectedly high stresses in the shell by reason of the bending effect. The girder work of the deck had also had the effect of concentrating the load mainly at certain points of the circle. Cast-iron had been exposed to a much higher tension than was realized and its unreliability under considerable tension has again been demonstrated by this occurrence.

The report contains numerous drawings illustrating the arrangements existing prior to the accident, together with important Appendixes giving the results of tests of the material by the National Physical Laboratory, and

by Messrs. Burstall & Monkhouse, and quoting in full independent reports by Dr. Lowe-Brown, Consulting Civil Engineer, and by Professor Coker, whose special photo-elastic methods of determining complicated stresses by the aid of models are well known. These reports confirmed the conclusions which had been reached by the Inspectors who make recommendations as to the avoidance of similar catastrophes in the future. In addition, reference is made to previous failures (accompanied by loss of life) which it is believed were attributable to causes of a similar character.

CAISSON DISEASE AND SANITARY CONDITIONS DURING CONSTRUCTION OF THE RAILWAY BRIDGE OVER THE KASANKA RIVER. *T. Kisselewa and M. Kisselew. Gigiena Truda, 1927, no. 2, pp. 14–25.*

Only the caisson workers (forty-five men) submitted to the authors' examination. Men aged 20 to 45 who were in excellent health and well developed muscularly were admitted to the work. For work in atmospheric pressures of 1.5 to 2, the shifts were three and a half hours long and the rest pauses eight and a half hours; for work in pressures of 2 or more, the shifts were two and a half hours long, the rest pauses nine and a half hours. Part of the examinations were made on workers in a chamber under increased pressure; another part on workers who had just left the caisson; and another after they had been out of the caisson two to three hours.

The authors found that under the influence of an increased pressure the volume of the lungs increases; the pulse rate is accelerated at first, later becoming slower; muscular power and fatigability (under a pressure of 7.2 to 8.8 kg.) do not change; hearing becomes acutely worse; weight decreases; and the erythrocyte count and hemoglobin percentage decrease. Treatment of the most usual caisson illness —pain in the joints—with decompression gave good results.—B. A.

HEAT, COLD, AND HUMIDITY

ARTIFICIAL HUMIDIFICATION IN THE COTTON WEAVING INDUSTRY. *A. B. Hill. Indust. Fatigue Res. Board, Rep. No. 48, pp. 73. H. M. Stationery Office, 1927.*

The conclusions of this report are unexpected in view of the controversy which has raged for some forty years relative to the influence on the health of weavers of using artificial humidity to assist the weaving process. The weavers have complained and humidification is controlled by law. The inquiry now reported started to obtain definite records of sickness experienced. The data were collected with the utmost care and were analyzed by modern statistical methods; they were gathered from 20,133 operatives employed in 76 "humid" sheds and 52 "non-humid," situated in five Lancashire towns. The methods pursued and the results obtained are given in considerable detail in a number of statistical tables; the sickness history was obtained from the National Health Insurance Approved Societies of which the weavers were members;

the atmospheric conditions prevailing in the weaving sheds were carefully noted throughout the period, Aug. 1, 1925, to July 31, 1926.

Comparison between humid and non-humid sheds revealed no significant difference between the two in the sickness experienced; a slight excess of sickness occurred among the operatives in the non-humid sheds. When grouped town by town, a similar result was obtained. Unemployment was not found an influence affecting the sickness rates. When the sheds were grouped, not by humidity depending on the introduction of moisture, but by actual thermometer records, no significant difference in sickness incidence was detected within the prevailing range of variation; nor was any difference found between the "very wet" and "very dry" groups. Further analysis was made to determine the possible existence of any form of sickness peculiar to one or the other group, but no evidence of such could be obtained.—E. L. C.

HEAT REGULATION AND GASEOUS EXCHANGE IN HIGH TEMPERATURE FOR MEN AT REST. *M. Marschak and W. Dawidoff. Gigiena Truda, 1927, no. 2, pp. 3–14.*

In the laboratory of the public Institute for the Protection of Labor experiments were made to inquire into the gaseous exchange, body temperature, pulse rate, and respiration of persons at rest, lying down, at first under usual living conditions in the so-called "outer chamber," then in the "heat (experimental) chamber."

The experiments were made with healthy students, aged from 22 to 24, who were used to muscular work. In preliminary experiments, the subjects were trained for a long time, so that they might become familiar with the procedure. Experiments were conducted at different temperatures and humidities, which correspond to from 30° to 36° on the effective temperature index.

On the basis of their findings, the authors reach the following conclusions:

1. At (moderately) high temperature there is chemical heat regulation, which causes a decrease in heat production, as well as physical heat regulation, which results in an increase of heat loss.

2. At moderately high external temperature, the organism reacts with a decrease in gaseous exchange. The latter begins to increase when the heat regulating mechanism operates insufficiently.

3. The temperature and humidity limits at which the human organism is capable of maintaining its thermal equilibrium lie between 28° and 29° on the effective temperature index. This corresponds to a wet kata cooling power between 7 and 8 millicalories per square centimeter per second when the air temperature is below that of the body and to one between 9 and 10 when the air temperature is higher than that of the body.

[Presumably, the variation in the kata cooling power is due to the changing conductivity of the human skin with external temperature, a factor of which the kata takes no account.]—C. P. Y.

WOMEN AND CHILDREN IN INDUSTRY

WOMEN IN TENNESSEE INDUSTRIES. A STUDY OF HOURS, WAGES, AND WORKING CONDITIONS. *U. S. Dept. Labor, Women's Bur., Bull. No. 56, 1927, pp. 120.*

This investigation covered 216 factories, stores, and laundries in twenty-seven cities and towns, in which 16,596 women and 106 girls under 16 years of age were employed. Of the latter, eighty-three were in textile and nineteen in cigar factories.

The Tennessee law permits a working day of ten and one-half hours, and a week of fifty-seven hours. Over four-fifths of the women have a day of nine hours or more; nearly half have a scheduled day of ten hours or more. Weekly hours were affected by the fact that so many of the women worked in textile factories, in which a short Saturday is common. Practically half had a weekly schedule of fifty-five hours or more, and less than one-tenth had a weekly schedule of forty-eight hours or less. Fewer than the scheduled hours were worked by 44 per cent. of those for whom time was reported, while 5.6 per cent. worked for more than the scheduled hours. For 60.8 per cent. of the women in stores, the Saturday hours were longer than the daily schedule.

Inadequate or unsatisfactory lighting was found to be a common condition, the natural light being found either inadequate or undesirable because of the glare it caused in ninety-eight establishments, while artificial light caused glare for some or all of the women employed in 116 establishments. Other undesirable conditions were narrow or obstructed aisles, and brick or concrete floors, with no wooden platforms provided for those who had to stand at their work. Unsatisfactory seating arrangements were common. In fifty-eight factories and laundries no seats were provided for women who stood at their work and in thirty-two factories and laundries none of the women who sat all day at their work had seats with backs.

WOMEN IN DELAWARE INDUSTRIES. A STUDY OF HOURS, WAGES, AND WORKING CONDITIONS. *U. S. Dept. Labor, Women's Bur., Bull. No. 58, 1927, pp. 156.*

This survey covered 146 establishments in twenty-nine cities and towns, employing 4,176 women. Manufacturing industries employed 56.2 per cent. of this number; canneries, 26.2 per cent.; mercantile establishments, 10.8 per cent.; laundries, 4.7 per cent.; and hotels and restaurants, 2 per cent.

Under the Delaware laws, a ten-hour day and a fifty-five-hour week for women is permitted in factories, stores, and laundries, but in practice better conditions than these were frequent. In restaurants and hotels, hours were found to be objectionable because of irregularity rather than because of length. In the canneries, the usual hour restrictions did not apply, and 31.5 per cent. of the women for whom hours worked were reported had a week longer than fifty-five hours.

General workroom conditions left much to be desired. Some plants maintained a high standard, showing that good conditions are possible, but more fell below what is desirable. Cleaning, heating, lighting, and venti-

lation were found to be unsatisfactory in a number of cases. "In 32 manufacturing establishments and 5 laundries, some of or all the women stood constantly while working, and in only about one-third of these firms were there chairs or stools available for occasional use." In forty-six of the factories visited some of the women sat at their operations. The ordinary stiff-backed kitchen chair was the common provision, but in sixteen plants some of the women sat all day on stools or benches without backs. Emphasis is placed on the fact that many jobs could be carried on with less expense to the employer and greater conservation of strength for the worker if suitable seating accommodations were provided.

WOMEN'S EMPLOYMENT IN VEGETABLE CANNERIES IN DELAWARE. *U. S. Dept. Labor, Women's Bur., Bull. No. 62, 1927, pp. 47.*

This is a reprint of the sections of the foregoing report which relate to canneries.

In Delaware, canning, because of its seasonal character, is the one exception to the law limiting the hours of work of women to ten a day and fifty-five a week. Some states, however, have restrictions regarding overtime in seasonal work and there seems no reason why others cannot pass similar legislation. There is considerable fatigue attending this work, owing to long hours of continuous standing, excessive noise, eyestrain from watching the rapidly moving conveyor, and posture necessary while cutting.

The disposal of excessive amounts of steam is the chief problem of ventilation. Many canners had made adequate provision for this by having the cooker and scalder in a room separate from that in which the peelers worked, and by having openings in the roof which gave the steam a ready means of exit.

Most of the canneries were cleaned twice a day, but it is the accumulation of water and waste between cleanings that affects the worker. There is an urgent need for more attention to equipping plants with platforms to keep the peelers off the wet and hard floor.

Drinking facilities were usually one and the same as the arrangement provided for washing buckets and pans; only about one-third of the canneries had provision for drinking other than that at the spigot or trough where the peeling receptacles were washed. Only nine of the thirty-four canneries visited made special provision of bowls for washing. Toilet facilities were, in most cases, far from satisfactory.—M. C. S.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

LIGHTING IN THE FACTORY. *A. M. H. Davies. Jour. Nat. Inst. Indust. Psychol., July, 1927, vol. 3, pp. 375–385.*

A general plea for better and more light in industry and for the use of the photometer in assuring constant, adequate illumination. The necessity of

adapting each installation to the special conditions encountered is pointed out.—M. G. P.

THE LIGHTING POWER OF FLAME SAFETY LAMPS. *R. F. Wheeler and D. W. Woodhead. Safety in Mines Res. Board, Paper No. 40, pp. 66. H. M. Stationery Office, 1927.*

The causative relation held to exist between miners' nystagmus and the illumination of coal mines gives considerable importance to investigations such as the one now reported into the lighting power of miners' lamps. The present report deals only with the lighting power of flame safety lamps; it describes a careful piece of scientific work directed to ascertaining how far the light given by lamps now in use can be improved without scrapping the lamps. An inquiry was made into the quality of the fuel used, into details of construction of the lamps, and into their general construction. On each side improvements can be made. The fuels used include mineral and vegetable oils and spirits. Investigation showed that the best result was obtained by using blends. The most satisfactory contained all three components, such as 1 part by volume of a petroleum spirit, of specific gravity not less than 0.72, to 7 parts of a mixture containing 1 part of paraffin and 7 parts of mineral colza. With this blend the candle power obtained was from 35 to 40 per cent. greater than with mineral colza alone. The shape of the burner was found to be important, and enhanced candle powers were obtained with a concave cut given to the wick tube, the wick itself being also cut or being allowed to become concave. Advantage was obtained from the use of wicks of about half the usual thickness; such wicks fed the fuel in a better proportion for combustion with the oxygen present. When the most suitable blend of fuel was in use and the most suitable wick, still advantage was obtained by using 20-mesh gauzes. An illumination of 2.5 candles was obtained with a lamp of normal dimensions for which all the foregoing matters were optimum. The report throughout is well and clearly illustrated and contains tables giving in detail the results of all the observations made.—E. L. C.

VENTILATION IN THE FACTORY. *M. F. Peterson. Jour. Nat. Inst. Indust. Psychol., July, 1927, vol. 3, pp. 368–376.*

A full and careful description is given of the use of the kata-thermometer for determining whether there is need for improvement in ventilation. Where improvement is required, the following general recommendations are made:

(a) Any structural alteration made with a view to increasing the air movement during the summer must be so planned that it does not correspondingly increase draughts during the winter.

(b) "Short circuiting" of air currents must be avoided. Thus, if an extraction fan is placed in one wall of a building, the inlets for air should be in the opposite wall, so that the air which is drawn out by the fan travels the full length of the room. If a window is open near an extraction fan, the effect of the fan may be lost, since instead of drawing air across the room it will merely extract the fresh air entering through the window.

(c) While electrically driven fans can be regulated, allowing of a certain amount of control over the air movement, open windows, in the absence of distributing fans, give little control and are practically useless

on calm days—the very time when their effect is most needed.

(d) When the temperature is below 50°F. and the workpeople are complaining of cold and draughts, the best remedy is, not to decrease the air movement by shutting all the ventilators and windows, but, leaving the ventilators untouched, to increase the temperature, thus establishing a suitable degree of warmth while maintaining adequate movement of air. It is easier to regulate conditions by means of temperature in the winter, and by means of air movement in the summer.

—M. G. P.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

PRACTICE OF PREVENTIVE MEDICINE IN INDUSTRY. *J. A. Turner. Am. Jour. Pub. Health, Nov., 1927, vol. 17, pp. 1125–1129.*

INDUSTRIAL INJURY STATISTICS OF METAL WORKERS. *J. A. Turner. Nation's Health, June, 1927, vol. 9, pp. 27–28.*

The author describes the preventive, curative, and educational programs of the medical department of the Laidlaw Works of the Worthington Pump & Machinery Corporation, and presents statistics from the records accumulated since the department was started in 1920. Records of injuries have been kept from the beginning but absenteeism due to illness has been recorded only since 1925 when a full time physician was first employed. From 1920 to 1925, 15,688 injuries were treated, of which only 1.8 per cent. were lost time cases. About 50 per cent. involved the hands, 85 per cent. of this number being injuries to the fingers; 38.8 per cent. involved the eyes; 4.2 per cent., the forearms; 2.7 per cent., the head; 1 per cent., the legs; 4 per cent., miscellaneous parts of the body. In 1920 the average number of days lost per man per year owing to injuries was 2.1; in 1925 this had been reduced to 0.99.

Specific industrial diseases have been practically eliminated in the plant. Nonindustrial sickness, however, causes considerably more loss of time than do injuries. Respiratory diseases were the most frequent single cause of both sickness and lost time. During 1925 they accounted for 32 per cent. of the total time lost from sickness and during 1926, for 26.8 per cent. Special efforts made in 1926 to reduce the frequency and severity of these diseases resulted in a material reduction in the severity, the days lost being 37.8 per cent. less than during 1925, but did not affect the frequency rate.

Gastro-intestinal diseases, the second most frequent cause of sickness, accounted for 29 and 35 per cent. of the sickness in 1925 and 1926 and for 8 per cent. of the total time lost; rheumatic and neuralgic diseases caused 4.5 per cent. of the time lost; and other diseases, including surgical operations and chronic diseases, caused 55 and 54 per cent. of the lost time in 1925 and 1926, respectively.

During 1926 there were 22.4 per cent. more requests for treatment of illness than during 1925, yet 26 per cent. less time was lost. The author ascribes the increased number of requests for treatment during 1926 to an educational campaign which en-

couraged the employees to seek treatment for their trivial complaints and injuries.—M. C. S.

SUCCESSFUL TUBERCULOSIS CLINIC WORK IN INDUSTRY. *D. G. Black. Nation's Health, Nov., 1927, vol. 9, pp. 25–28.*

The author describes the work of the tuberculosis clinic of the Westinghouse Electric and Manufacturing Company at East Pittsburgh, which has been maintained as a unit of the tuberculosis division of the Pennsylvania Department of Health for the past six years.

INDUSTRIAL NURSING

THE PLACE OF THE VISITING NURSE IN INDUSTRY. *E. L. Foley. Nation's Health, Oct., 1927, vol. 9, pp. 29–30, 64.*

"The visiting nurse in industry . . . . can prevent many of the hopeless tragedies that swell the pension lists of large firms and the charity list of philanthropic agencies. She can help restore the worker to his job more promptly; she can also prove to the worker and his family that the firm is not a huge, impersonal creation, interested in the individual only when he is able to deliver 100 per cent of his energy, but that she, as one of its representatives, is the substitute for that old intimacy that existed in the little plant when the employer knew all of his employees and most of their families."

VISITING NURSE'S POSITION IMPORTANT IN INDUSTRIAL MEDICAL WORK. *E. L. Foley. Hosp. Management, Oct., 1927, vol. 24, pp. 70–72.*

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

THE PERSONNEL POLICIES OF PENNSYLVANIA DEPARTMENT STORES. *Pa. Dept. Labor and Industry, Special Bull. No. 13, 1926, pp. 55.*

This report, which represents "a broad cross-section view of the many different phases of department store life," is based on conditions in thirty-two department stores selected from thirteen cities throughout the state. No information was solicited from any employee and the results of the study are based largely on the employer's presentation of conditions in his own establishment.

Of the thirty-two stores studied, 62.5 per cent. had a scheduled week of less than fifty hours and no store had a basic week exceeding fifty-two and one-half hours; the scheduled hours, however, are not necessarily the actual hours worked. Time clocks were in general use but were required only as a check on absenteeism and were not consistently punched for overtime work. Consequently none of the establishments could offer accurate information as to the actual hours worked. Many employers not only have closed their stores on Saturday nights but have initiated the policy of giving a weekly half holiday during the summer months. Eighteen stores also had shorter daily working hours in summer.

Lunch periods varied in length

from forty-five minutes to an hour and a half. The longer lunch period and the shorter weekly hours were closely allied. Of the six stores allowing only the forty-five minutes required under the Woman's Labor Law, five had weekly hours of fifty or more. These six stores, however, provided cafeterias in the building. The time given for lunch did not vary to any appreciable extent for men and women or for the groups in selling and nonselling departments.

Basic weekly hours were shorter for twenty of the twenty-five stores in 1926 than in 1910; they were shorter for six of the stores in 1926 than in 1920. This trend toward shorter hours seems to be the result of a movement of the merchants themselves and of public opinion, rather than of laws.

The summer vacation with pay has evidently become an established custom. Thirty-one stores had a definite policy which provided for vacations with pay and which affected all employees alike. The other store permitted persons who had been employed for one year or more to take a vacation, but whether they were paid was decided by the individual department managers. Vacations without pay were allowed in all of the stores. In one store where a week's vacation with pay was given, each employee was required also to take an additional week without pay.

Of twenty-eight stores from which information regarding seating was obtained, five met only the minimum requirement of one seat for every three women. Many stores provided a seat for each woman employee. In seven stores where seating was inadequate, the problem seemed largely one of poor distribution rather than lack of seats. Behind counters, stools and "let down" seats were used chiefly. In nonselling departments fifteen of the stores used stools without backs for part of the employees. The only posture chairs found were those which had come with some special equipment, as filing cabinets or calculating machines.

Very few stores seemed to be giving special attention to regulation of temperature. In seventeen stores thermometers had been installed but rarely was anyone designated to regulate the temperature on the basis of the thermometer readings. In a few stores systems of artificial ventilation were installed.

Although rest rooms are required in all industrial establishments employing women, up to the time of this study the regulations did not obtain in mercantile establishments. The Department of Labor and Industry is, however, considering the adoption of regulations requiring a rest room and couch in all establishments employing more than five women.

In most of the stores adequate toilet rooms, washing and drinking facilities, and dressing rooms were provided. In seven stores, however, no provision was made for employees' wraps; coats, hats, umbrellas, and even overshoes were stowed away behind the counter. On the whole the lunch room problem was met very satisfactorily. Only two stores had no room provided for this purpose; thirteen had cafeterias for the exclusive use of employees.

The appendix to this report contains digests of the labor laws governing the employment of women and children in

mercantile establishments, and the questionnaire used in the investigation.—M. C. S.

THE WELFARE ARRANGEMENTS ON THE FEDERAL RAILWAYS. *Foreign Letter (Berlin), Jour. Am. Med. Assn., Jan. 14, 1928, vol. 90, p. 133.*

The Deutsche Reichsbahngesellschaft has published a report on the social insurance system and the welfare arrangements in vogue during 1927. Welfare work among employees while on duty has been well developed. In the smaller stations recreation rooms and lodgings have been provided, and at the larger, remote stations bachelors' quarters have been erected. At all large railway centers, bathing facilities are furnished. Workmen are afforded opportunities to prepare their meals, and refreshments—coffee and other nonalcoholic beverages—are supplied on every hand. The station concessionnaires are under contract to furnish the personnel beverages and nutritious food at reasonable prices. Attention is given to the avoidance of accidents, and the first aid service is well developed. First aid kits are kept in the baggage cars, in the coaches of the express trains, at the stations, and at other centers. Physicians and ambulances are also readily available. At the close of 1926, there were 64,764 railway employees who had been trained in the "Samaritan service."

For the fiscal year 1927, $476,000 was expended in the crusade against tuberculosis. In 1926, 8,224 officials, employees, and workmen (and their families) received tuberculosis benefits from the funds of the federal railways, while 1,594 adults and 3,852 children were given protracted treatment in health centers and climatic resorts. The railway physicians are required to give talks. The self-help efforts of the personnel are aided by the federal railway administration through special grants, reliefs from service, free transportation, and the like. Further self-help arrangements exist in the form of the death benefits fund, the daughters of railway employees fund, the sons of railway employees fund, welfare centers, vacation colonies, children's homes, and convalescents' homes of the various associations of railway employees.—K. R. D.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

THE PRESENT STATUS OF SO-CALLED "TRAUMATIC NEUROSES." *L. F. Barker. Nation's Health, Sept., 1927, vol. 9, pp. 12–14.*

Dr. Barker presents the views of the neurologists and psychiatrists who, in his opinion, have made the most thorough studies of the subject. He believes that the rank and file of the medical profession as well as physicians who examine prospective employees should become better acquainted with the present status of the problem. He also suggests that the whole subject might well be carefully considered with regard to past social legislation and particularly with regard to the enactment of any new compensation laws.—E. D.

HERNIA IN RELATION TO INDUSTRIAL SURGERY. *H. S. McKay. Jour.*

Missouri State Med. Assn., Nov., 1927, vol. 24, pp. 500–502.

In this address, read at the Seventieth Annual Meeting of the Missouri State Medical Association, the author reviews the most recent opinions of authorities who have investigated the subject of industrial hernia and presents his own views formed on the basis of a number of years' experience with hernia cases. Attempts have been made by several state commissions to solve the confusing problem of industrial hernia, but the following ruling of the Industrial Commission of Nevada, in the author's opinion, seems most in accord with present knowledge of the causes of hernia:

Rule 1. Real traumatic hernia is an injury to the abdominal (belly) wall of sufficient severity to puncture or tear asunder said wall, and permit the exposure or protruding of the abdominal viscera or some part thereof. Such an injury will be compensated as a temporary, total disability, and as a partial, permanent disability depending upon the lessening of the injured individual's earning capacity.

Rule 2. All of the hernias, whenever occurring or discovered, and whatsoever the cause, except as under Rule 1, are considered to be diseases causing incapacitating conditions or permanent, partial disability. But the permanent partial disability and the causes of such are considered to be shown by medical facts to have either existed from birth, to have been years in formation and duration, or both, and are not compensatory except as provided under Rule 3.

Rule 3. All cases, coming under Rule 2, in which it can be conclusively proven (1) that the immediate cause which calls attention to the presence of the hernia, was a sudden effort or severe strain or blow received while in the course of employment; (2) that the descent of the hernia occurred immediately following the cause; (3) that the cause was accompanied, or immediately followed, by severe pain in the hernial region; (4) that the above facts were of such severity that the same were noticed by the claimant and communicated immediately to one or more persons are considered to be aggravations of previous ailments, or diseases, and will be compensated as such for time and loss, and to a limited extent only, depending upon the nature of the proofs submitted and the result of local medical examination.

In conclusion, the author emphasizes the importance of physical examinations prior to employment, as a means of eliminating malingerers, and the necessity of bringing to the attention of physicians all knowledge pertaining to the etiology of hernia, as a means of obviating much diversity of opinion with reference to the medico-legal aspect of the problem.—M. C. S.

THE WORKMEN'S COMPENSATION ACT OF MISSOURI. *W. L. Small. Jour. Missouri State Med. Assn., Nov., 1927, vol. 24, pp. 504–506.*

The author gives a digest of the chief points embodied in the Workmen's Compensation Act of Missouri which became active Jan. 8, 1927. Until November, 1926, Missouri was one of six states having no workmen's compensation law.

A list is given of the forty-six permanent partial disabilities named in the Act, with the number of weeks to which the employee is entitled to compensation. The maximum amount is for the loss of an arm at the shoulder. For this loss the employee is entitled to compensation for 232 weeks, or $4,640, plus all medical and surgical bills pertaining thereto, provided his wages were $30 or more a week and not more than $3,600 a year. The minimum amount is for the loss of any

toe, except the great toe, at the distal joint. For this injury the employee will receive compensation for eight weeks, or $160, plus all medical and surgical bills pertaining thereto. For the loss of the sight of one eye, the employee will receive compensation for 108 weeks, or $2,160. For the loss of an eyeball, 118 weeks, or $2,360. For loss of hearing in one ear, forty-four weeks, or $880; for loss of hearing in both ears, 168 weeks, or $3,360.—M. C. S.

WORKMEN'S COMPENSATION ACT OF MISSOURI. *J. H. Caruthers. Jour. Missouri State Med. Assn., Nov., 1927, vol. 24, p. 506.*

SILICOSIS, PNEUMONOCONIOSIS, AND CAISSON DISEASE MADE COMPENSABLE IN ONTARIO, CANADA. *U. S. Month. Labor Rev., Aug., 1927, vol. 25, pp. 288–289.*

During 1926 the list of industrial diseases covered by the Workmen's Compensation Act of Ontario was enlarged to include silicosis in mining communities; pneumonokoniosis in quarrying, crushing, and grinding of stone and metals; and caisson disease in deep sewer work.

"The most important of these diseases in Ontario from the standpoint of the numbers involved is silicosis, a very considerable number of miners suffering from the disease having been found in the mining camps. In a conference between the representative mine owners, the department of industrial hygiene, and the workmen's compensation board, it was agreed that three distinct stages of the disease should be recognized in awarding compensation. These are the ante-primary, the primary, and the secondary stages. In the first stage in which silicosis is present but has not progressed far enough to cause physical impairment if the man is removed from further exposure to silica dust, compensation to the amount of $500 is allowed to cover the cost of rehabilitation in another industry. In the primary stage, in which some degree of impairment is present, the compensation was fixed at $1,000 to cover permanent disability and rehabilitation in another industry; and in secondary silicosis, which is usually complicated with tuberculosis, when total disability is reached the compensation for permanent total disability is awarded. Early in 1927 a silicosis board, consisting of four doctors, three from the department of public health and the reporting physician, was established. The decisions of this board as to whether the claimant is suffering from the disease and, if so, as to what stage he is in must be unanimous, and the decisions of the board are final.

"In connection with several deaths from caisson disease in Toronto in sewer work which was being carried on in compressed air it was decided that such deaths could not be regarded as of an accidental nature, but that they are incidental to the carrying on of the work in compressed air, and therefore in order to be compensated would have to be added to the industrial-diseases section of the act. The disease was accordingly added to the provisions of the act by regulation of the board, to take effect from January 1, 1926."

REHABILITATION OF DISABLED EMPLOYEES

INDUSTRIAL LIFE OF THE BLIND IN CENTRAL EUROPE. *D. R. Carmer. Occup. Therapy, Dec., 1927, vol. 6, pp. 463–471.*

A description is given of the conditions under which the blind are working in Austria, Czechoslovakia, and Germany. In Austria the blind man is, for the most part, limited in his work to piano tuning, chair caning, brush making, and basket weaving. In Vienna there are eight or nine men working in a pulp factory and giving satisfactory results. This work could be more thoroughly manned by the blind and undoubtedly will be, when the problem of unemployment among normal workmen is less serious. The tobacco shops are owned by the government and on the application lists veterans blinded during the war are given preference.

In Czechoslovakia, as in Austria, the war blinded have first call on the tobacco shops owned by the government. There is definite placement work being done in Prague, but there are limits to the work, owing to the general unemployment factor. A large manufacturer of shoes in this city is employing fifty blind persons with perfect satisfaction; an electrical factory is employing five; and a tobacco factory is keeping 203 blind girls at work.

In Germany employers are responsible for giving employment to a certain percentage of the war handicapped and all blind are included in this term. There must be two handicapped persons to every 100 employees. A committee for examination and adaptation of new professions and working possibilities for the blind has been formed by representatives of industry and trade, as well as blind experts, with the result that about 200 possibilities have been given blind people, through adaptation of machines, etc., in trades manned by the sighted. There is also a state commission which looks after the interests of the blind. About 150 blind typists are employed in Germany, seventy of them in offices in Berlin. There are factory placements in the following trades: document binding, metal, tobacco, food, chemical, paper and cardboard, brush, cloth, and dress manufacturing. In one factory of the Siemens-Schuckert Works ninety-eight blind men are employed. The machines have all been provided with suitable safety devices; punching machines are so arranged that they cannot operate without both hands working the lever, riveting machines automatically push the hands away when they come too near, and so on. The blind men are always seated next to men able to see, often working on the same process. A convalescent home on the Baltic is maintained by the Siemens-Schuckert Works and a four-weeks' holiday yearly, with railway fare there and back, is given every blind employee.—M. C. S.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

OCCUPATIONAL MORTALITY, FERTILITY, AND INFANT MORTALITY. THE REGISTRAR-GENERAL'S DECENNIAL SUPPLEMENT. PART II. *H. M. Stationery Office, 1927, pp. 138.*

The decennial supplements dealing with occupation, issued by the Registrar-General for England and Wales, are always important documents. The one which has just appeared is more so than usual. It is the eighth in the series which commenced in 1851. But continuity for comparative purposes has been largely broken, in order to make the facts presented more definitely occupational, and less industrial, than heretofore. In the past, for instance, coal mining was taken as a whole; now the hewer and coal getter is kept separate from other workers below ground, from workers on the surface, and also from colliery managers and foremen. The result is to accentuate, but still only to present in true perspective, causes of death due to occupational hazards. Another alteration has been to calculate comparative mortality figures for ages 20 to 65, instead of for ages 25 to 65. The standard used for the calculation is a population of 109,296 males, which yielded exactly 1,000 deaths at the death rates for different ages prevailing among all occupied and retired civilian males in 1921, 1922, and 1923. These changes were needed; and, while we regret the impossibility of comparing the comparative mortality figures of this report with those of previous reports, we appreciate that more is gained than is lost.

The first part of the report is remarkable for the comparison instituted between mortalities from various causes, as they occur in various social grades of the population. For this purpose the population is divided into five classes, grading from Class 1, which may be said to represent "luxury," to Class 5, characterized by "misery." Certain diseases have long been known to possess definite social distribution; of these bronchitis is the most definite, next comes phthisis, and not far behind, we now find, cancer. In each case the incidence of the disease increases from Class 1 to Class 5. The data relating to cancer have received close and intensive classification and consideration. The following new facts emerge: Apart from cancer of the skin with its definite occupational causation, cancer of the lip, tongue, jaw, esophagus, and stomach as far as the pylorus is found, for each site named and in the order stated, to increase in prevalence from Class 1 to Class 5; but, when the pylorus is passed, cancer is found attacking the remainder of the digestive tract, and indeed other organs as well, quite indiscriminately when distributed according to social class. Why cancer of the upper alimentary tract displays this remarkable social incidence is not at once obvious. Two diseases show a social grading exactly opposite to those just mentioned; they are diabetes and alcoholism. Diabetes, at least in middle and later years, appears to be related to financial capacity for overindulgence in dietetic indiscretions; alcoholism appears largely to have altered its incidence with the cost of the commodity which causes

it, and, as a cause of death, to have become largely the possession of those who can afford to buy it.

Apart from this discussion of the social status of causes of death, the male population is distributed according to various occupations, 178 in number. The section of the report dealing with these occupations is lengthy, but full of interest. As usual, agricultural occupations are found in the most favorable position, with consistently low mortality records. The facts dealing with coal miners are given in considerable detail, not only are the occupations kept separate, as already remarked, but the mortality set up by various causes of death is given for fourteen coal fields separately. The coal miner during the last ten years has improved in mortality, but somewhat less than the community as a whole, consequently he no longer takes so favorable a position as heretofore. Again considerable differences are disclosed between the different coal fields, and the coal getters of Lancashire and South Wales are found with mortalities in excess of the average. No new risk is brought to light among these miners, unless it be certain, not too definite, indications of the existence of some silicosis due to exposure to rock dust while sinking shafts or driving roads to get at coal seams. Some excess of phthisis is found among miners getting iron ore, which is known to contain small amounts of silica. But the great outstanding group, small though its numbers, which suffers from the dust hazard is that of tin and copper miners, for whom the comparative mortality figure for phthisis is ,2061 as compared with 163 for the standard; for bronchitis it is 248 compared with 49. After this group, stone and slate workers, bad though they are, seem almost favorable. When stonemasons are dealt with, the group is subdivided according to the stone worked, which varies in different parts of the country; sandstones are nearly exclusively manipulated in Cheshire, Lancashire, and the West Riding of Yorkshire. Limestones, on the other hand, are worked in the south and west. This subdivision gives to the sandstone mason a comparative mortality figure of 2,068 compared with one of 1,197 for the limestone mason; this excess is nearly entirely accounted for by undue mortality from phthisis and other diseases of the lungs among the sandstone masons. Other groups experiencing a silica risk and also standing out with a high mortality from phthisis and respiratory diseases are: certain pottery workers, such as mill workers and earthenware and china oven men; metal grinders and grinders in the cutlery trade, who are now kept separate from the metal polishers and buffers.

High phthisis rates are also found, not associated with any dust risk in certain other occupations, such as tailors, and cutters of textile goods; boot and shoe clickers, and skilled boot and shoe operatives; hand compositors, and machine compositors; printing machine minders, and bookbinders. These three industries—tailoring, bootmaking, and printing— are usually considered to have become infected with the disease, rather than that they offer any occupational risk to the workers. Then also hotel keepers, cellarmen, barmen, and waiters, all of whom suffer in excess from alco-

holism, are found with a high mortality from phthisis. Some occupations with similar high mortalities would appear to owe them to the fact that workers with the disease drift to these occupations, because they are thought to be either lighter or more out of doors; such are bus and tram conductors, messengers and hall porters, insurance agents and costermongers. In these respects the new records resemble those of previous years varying only in the exact amount of excess present.

A new and remarkable fact is brought to light with regard to glassworkers, of whom both the glass blowers and other skilled glasshouse workers and such skilled glassworkers as engravers and cutters are all found with an excess mortality due to diabetes. In 1910 no such excess was recorded, but in 1900 the glassworkers' excess was about 50 per cent. and in 1890 the excess was 200 per cent., which does not differ greatly from the present experience. The reason for this excess is yet to be determined.

Occupational cancer risk is practically confined to cancer of the skin, if cancer of the bladder due to aniline be excepted; and recognition that the cases originate from exposure to distillation products of vegetable matter, such as coal tars and shale oils, enables the causation in a number of cases to be recognized. Patent fuel workers, cotton spinners, and chimney sweeps lead the list with their exposure to coal tar pitch, mineral oil, and soot, respectively; then come stokers and coke oven workers, exposed to tar and heat; bargemen and seamen are also exposed to tar, while machine compositors and brickmakers come in contact with certain lubricating oils. Heat alone may have to be condemned, as in the case of puddlers and glasshouse workers, but, taken as a whole, examination of cancer by occupation in the present series of records has not brought to light any new risk. Only close and careful research and investigation can determine the full value of the data now so carefully presented.

Without doubt this volume must be a source of reference for years to come when anything occurs which gives rise to the suspicion that this or that occupation may present some risk previously unrecognized. Sufficient to say for the moment that the tabular matter is set out clearly and excellently with due regard to saving space; and the reader who familiarizes himself with the contents of the report will find that there is little he can want with regard to the presentation of the matter which is not therein contained.—E. L. C.

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

CARBON MONOXIDE AS A TISSUE POISON. *J. B. S. Haldane. Biochem. Jour., 1927, vol. 21, pp. 1068–1075.*

The case has been stated that, apart from its interference with the oxygen carrying properties of hemoglobin, carbon monoxide is no more poisonous than nitrogen; it is based on the fact that the gas is relatively harmless to invertebrates, micro-organisms, and plants which do not depend on hemoglobin for their oxygen. Experiments are described in which moths, seeds, and rats were exposed to atmospheres containing varying amounts of oxygen and carbon monoxide. The rats were placed in an atmosphere containing just sufficient carbon monoxide to unite with all their hemoglobin, and, in addition, oxygen at several atmospheres' pressure in order to impregnate the blood serum with the gas. Under these circumstances sufficient oxygen can be conveyed to the tissues. If, however, the amount of carbon monoxide was at this stage increased, the rats died. In the case of seeds and moths, the oxygen in the atmospheres was lowered until the reactions became sluggish. It was found that if carbon monoxide was admitted to the atmosphere the reactions required more oxygen to be present than if no carbon monoxide was present; but that more carbon monoxide was required in the case of

seeds than for moths. In fact the movements of moths and the germination of cress seed was inhibited by carbon monoxide; and the greater the partial pressure of oxygen, the more carbon monoxide was required. The conclusion is drawn that living tissues contain a catalyst of oxidation which is poisoned by carbon monoxide, and the suggestion is made that the catalyst may be an iron-porphyrin derivative, a component of the polyphenol oxidase system, which is required to enable oxidation to take place in bacteria, yeasts, higher plants, and insects which possess no hemoglobin, but which is also present in the tissues of mammals.—E. L. C.

EFFECTS OF CARBON MONOXIDE INHALATION UPON METABOLISM. *F. M. Walters. Am. Jour. Physiol., 1927, vol. 80, pp. 140–149.*

From experiments on white rats, undertaken for the purpose of determining what effects upon the rate of an animal's metabolism might result from the breathing of carbon monoxide in controlled concentrations in air, the author concludes as follows:

1. Carbon monoxide depresses the rate of metabolism, the degree of depression varying directly with the degree of saturation.

2. There is a lowering of body temperature that corresponds closely with the slowing of the metabolic rate.

3. The breathing of carbon monoxide concentrations of from 0.02 to 0.05 per cent for short periods (1 to 2 hours) has little if any effect upon the rate of metabolism of the rat, but for long periods (4 to 6 hours) it depresses the rate in individual cases.

4. Concentrations above 0.05 per cent have marked effects in depressing the rate even for short periods of exposure.

5. There is a correlation between the fall in the metabolic rate and the symptoms of carbon monoxide poisoning.

A CASE OF PSYCHOSIS FOLLOWING CARBON MONOXIDE POISONING. *E. Mattauschek. Abstr. as follows from Wien. med. Wchnschr., 1927, no. 37, in München. med. Wchnschr., Nov. 11, 1927, vol. 74, p. 1934.*

One of the rare cases in which, some time (two weeks) after acute carbon monoxide poisoning, severe psychotic disturbances develop and do not subside for a considerable length of time (six months).

THE TOXICITY OF ETHYLENE CHLORHYDRIN. *F. Koelsch. Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 312–316.*

The author describes seven cases of poisoning, two of which were fatal, due to ethylene chlorhydrin, a chlorinated alcohol which is used as solvent for resin, wax, acetylcellulose, etc. Animal experiments which he carried out in order to verify his clinical observations showed the substance to be very poisonous both when inhaled and when absorbed through the skin.

Ethylene chlorhydrin has a severe effect on the nervous system and on metabolism. This effect does not appear, however, until some time after exposure. Local irritation of the superficial mucous membranes and of the deep air passages also occurs. There seems to be present a special individual susceptibility; in the fatal cases there were more or less far-reaching organic changes which favored poisoning and the fatal effect. Besides the personal factor there must be certain external factors—large surfaces of evaporation and increased volatility as a result of high temperature.

Work in which there is danger of evaporation of ethylene chlorhydrin

should be carried on only in airy rooms supplied with ample artificial ventilation. Workers should be warned of the danger of skin absorption and should avoid getting the substance on their skin and their clothing. Exclusion of sickly persons and regular alternation of employment are indicated.—M. C. S.

THE QUESTION OF CHRONIC HYDROGEN SULPHIDE POISONING. *Rodenacker. Abstr. as follows from Zentralbl. f. Gewerbehyg., June, 1927, N. S. vol. 4, pp. 205–207, in München. med. Wchnschr., Nov. 25, 1927, vol. 74, p. 2031.*

Following inhalation of hydrogen sulphide in a concentration of over 1.5 volumes per thousand, the organism very rapidly loses its capacity to utilize the oxygen available; these disturbances of oxidation in the highly sensitive ganglion cells determine the clinical picture of hydrogen sulphide poisoning. Smaller doses (0.15 to 1.15 volumes per thousand) also cause local disturbances of oxidation, for instance, in the skin and the mucous membranes. Repeated acute poisonings seem to be endured by the body without injury. The author believes that accounts of "chronic poisoning" must be rejected as subjectively influenced; at least, he has been unable thus far to establish any objective clinical proof of chronic injury. There probably does exist, however, an individual limit to tolerance.—M. C. S.

LEAD PSYCHOSIS IN A LEAD BURNER, ENDING IN SUICIDE. *W. Hergt. Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 294–298.*

This is a discussion of the medical and legal aspects of a case for which compensation was claimed by the widow of the decedent.

The patient was a lead burner for about ten years. He had a history from childhood of violent temper which had brought him several times into the hands of the law, and of extreme brutality in his family life. Plumbism was never diagnosed, although he had visited physicians several times, and finally applied to the eye clinic because of sudden impairment of vision in both eyes. No evidence of plumbism was found at that time. There was paralysis of the internal muscles of the eyes, and later disturbance of the pupillary reaction. During this time he was allowed to keep on with his work. He became progressively insane and was consigned to an asylum for about a year when his improvement was considered sufficient to allow him to be sent home, but on the following day he drowned himself. The widow applied for compensation on the ground that this was a lead psychosis, and the expert decision was given in her favor. Hergt defends it on the ground that the symptoms were consistent with those of lead psychosis; the man was exposed to lead. Syphilis and alcoholism were both ruled out, and the employer was guilty of a serious error in allowing him to continue in his work of lead burning after the disturbance of vision had occurred.—A. H.

POISONING BY VOLATILE LEAD SALTS. *J. S. Manson. Brit. Med. Jour., Jan. 21, 1928, vol. 1, pp. 114–115.*

The case is reported of a furnaceman at a steel works who exhibited symptoms of lead poisoning. The ore used contained a small proportion of lead

which was inhaled as fumes when the molten metal was run off. Examination of other workers disclosed in them also the presence of lead absorption. —E. L. C.

TETRA-ETHYL LEAD. THE RISKS OF ITS ADDITION TO PETROL. *Brit. Med. Jour., Jan. 14, 1928, vol. 1, pp. 61–62.*

TETRA-ETHYL LEAD. *Ibid., pp. 64; 74–75.*

Recently, under the trade name of Ethyl, the introduction to the British market of petrol containing tetraethyl lead is being widely advertised. This mixture has been proved a success for preventing "knocking" in America, where also it has been proved a potential danger to health. Attention is drawn to research investigations in the United States, and to the different symptoms from ordinary plumbism caused by this compound of lead. The government have expressed confidence that no danger exists from the use of Ethyl, but this view is objected to, particularly in a letter by M. Coplans. He points out that the use of Ethyl is interdicted in Switzerland and is subject to trade regulations in America. The public require to be instructed in the danger attendant upon contact with this fluid or with exhaust gases from its combustion.—E. L. C.

WORKING CONDITIONS IN THE MANUFACTURE OF NITRIC ACID BY THE HART METHOD. *W. Navrozky. Gigiena Truda, 1927, no. 2, pp. 25–30.*

By the Hart method nitric acid is obtained from the decomposition of saltpeter by sulphuric acid. Exposure to fumes of nitrogen oxides and danger of nitric acid burns are the chief hazards.

Forty-one examinations of the air content in the workrooms, in different places, showed oxides of nitrogen present per liter of air as follows: minimum 0.007 mg., maximum 2.448 mg., average 0.1248 mg.

In the course of four months, five cases of poisoning by nitrogen oxide were established which proved to be only light cases, with incapacity for work lasting ten days. In 1925 there were eleven cases of burns from nitric acid (out of a total of twenty-seven workers), five of which resulted in absence from work lasting sixty-seven days.

From the point of view of health protection the Hart method is unsatisfactory. Of all the methods by which nitric acid is obtained by decomposition of saltpeter, the Valentine method is most to be recommended.—B. A.

INDUSTRIAL THALLIUM POISONING. *Rube and Hendricks. Abstr. as follows from Med. Welt, 1927, p. 733, in München. med. Wchnschr., Nov. 25, 1927, vol. 74, p. 2031.*

Six persons in a chemical plant became ill, complaining of fatigue, loss of appetite, pain in the knees, and loss of hair. The blood showed eosinophilia and lymphocytosis; in two cases albuminuria was present. In the worker who was most seriously ill there were disturbances of vision, as a result of progressive optic atrophy.—M. C. S.

STUDIES CONCERNING THE HYGIENIC PROPERTIES OF TITANIUM DIOXIDE AND TITANIUM WHITE. *K. B.*

Lehmann and L. Herget. Chem.-Ztg., 1927, no. 82, p. 793.

Monazit sand from Brazil, India, and Ceylon serves as raw material for the production of nitrate of thorium for gas mantles and cerium compounds which have many uses. In addition, this sand yields mesothorium and helium, and also silicate of zirconium and titanium. The last has lately been used for the production of titanium dioxide for the painting trade. This compound is also produced from titanium ores which are found in North America and Norway. In Germany the use of titanium dioxide for white paint has been introduced during the past two years, and Lehmann was asked to determine its toxicity. The literature shows that titanium is widely distributed in earth, stone, plant ash, woods of various kinds, beans, cottonseed meal, as well as in animal flesh and bones and also in the human body. The feeding experiments, carried out on four cats, two rabbits, two guinea-pigs, and a dog, showed that large doses administered during 16 months were without effect. Titanium white paint, therefore, which consists of a mixture of titanium dioxide with barium sulphate and zinc oxide, fulfils the requirement of an absolutely harmless white paint.—A. H.

DUST HAZARDS AND THEIR EFFECTS

THE ORIGIN OF HISTIOCYTES (MACROPHAGES) IN THE LUNGS. AN EXPERIMENTAL STUDY BY THE USE OF INTRATRACHEAL INJECTIONS OF VITAL STAIN. *B. M. Fried. Arch. Path. and Lab. Med., May, 1927, vol. 3, pp. 751–767.*

The author's conclusions are as follows:

1. The phagocytes or "dust cells" in the pulmonary alveoli in inflammatory and congestive processes are macrophages or histiocytes, and therefore cells of mesenchymal origin.

2. These cells originate from the nucleated cells, commonly spoken of as the (respiratory) epithelial cells lining the wall of the pulmonary alveoli.

3. The so-called epithelial cells lining the pulmonary alveoli are to all appearances not epithelial but cells of mesenchymal origin—that is to say they are histiocytes, and belong to the reticulo-endothelial system.

SILICOSIS AS AN INDUSTRIAL HAZARD IN ONTARIO GOLD MINING. *O. G. Hague and R. W. McBain. Am. Jour. Roentgenol., Oct., 1927, vol. 18, pp. 315–322.*

"Probably the most extensive survey on the North American Continent along the lines of pneumoconioses was completed in the year April 1, 1926 to April 1, 1927 on silicosis in the Porcupine Gold Mining Camp of Northern Ontario.

"This survey was made under the auspices of the Mine Operators of the Porcupine group of mines in compliance with the amendment to the Miner's Phthisis Act of April 8, 1926, bringing silicosis under the status of a compensable industrial disease."

Approximately 4,000 miners were examined for tuberculosis, silicosis, or both. As a result 94 claims (of silicosis) were submitted for compensation. Using the South African nomenclature, of these 94, 39 were ante-primaries, 28 primaries, and 27 secondaries; 247 men in addition

showed either positive or probable tuberculosis.

In the summary the authors state:

1. The local incidence of silicosis is low in comparison with the Rand of South Africa.

2. The pulmonary condition, as roentgenographed, presents here a picture with contrastingly softer shadows than those from South Africa.

3. "The condition is of much less serious nature and would seem to be caused by rock dust (*a*) other than silica, (*b*) containing a small percentage of siliceous dust mixed with that from silicates and other accessory minerals" (C. M. Omerod).

4. Tuberculosis is the predominating serious factor but does not exist to nearly the same extent or virulence as that of South Africa.

—P. D.

THE RED BLOOD PICTURE OF CEMENT WORKERS. *W. Saleck. Arch. f. Hyg., 1928, vol. 99, no. 1–2, pp. 60–70.*

From a study of 253 workers in three Portland cement factories, the author draws the following conclusions:

1. Through the effect of cement dust on workers in cement factories, the polychromatic erythrocytes are greatly increased. In a small number of the workers the basophilic erythrocytes showed fine or very fine granulations.

2. Basophilic granular erythrocytes like those due to lead were not found in men exposed to cement dust.

3. Photography is recommended for the determination of the average number of erythrocytes (polychromatic?) per microscopic field.—A. H.

IDIOSYNCRASY TO BARLEY DUST. *E. Urbach and M. Steiner. Arch. f. Dermat. u. Syph., Oct. 23, 1927, vol. 153, p. 772.*

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

WHAT IS PHYSICAL EFFICIENCY? *W. D. Hambley. Health, Feb., 1928, pp. 230–236.*

Some account is given of different efforts, in which the author took part, to measure physical efficiency. One test was, after breathing deeply, to raise by expiration the column of mercury in a manometer by 40 mm. and hold it so for twenty seconds. Performance was followed by slowing of the pulse rate by, perhaps, 10 beats per minute at 9 A.M., but by 30 beats at 5 P.M. after a day's manual work. Systolic pressure was also observed during the manometer test. Least variations in pulse rate and systolic pressure occurred in the fitter subjects, and *vice versa;* but men of poor physique, not sensitive to discomfort, might do better than highly sensitive athletes. Pulse rates vary with exercise, such as stepping up and down a stair tread, and with age. They ranged for healthy males from 52 to 106 per minute, and for females from 53 to 116. After exercise, such as running a mile, those in best training recovered their normal pulse rate most quickly. A low resting pulse rate was found of value, since it allowed greater range on exercise before the speed limit of the heart was reached. Finally, although the stair

tread exercise was favored as a test, the author concludes that there can be no real test for physical fitness for every and any kind of occupation. A man in perfect health may be fit for one form of muscular work rather than another, and his capacity can only be tested by performance of the work in question.—E. L. C.

INDUSTRIAL FATIGUE IN RELATION TO ATMOSPHERIC CONDITIONS. *H. M. Vernon. Physiol. Rev., Jan., 1928, vol. 8, pp. 130–150.*

This is a brief review of the evidence collected by the author in various industries, particularly in hot and dusty trades, which shows that atmospheric conditions affect the output and health of the workers considerably. (For detailed accounts of Vernon's work, see THIS JOUR., 1926, vol. 8, p. 392; 1927, vol. 9, p. 287.)—C. P. Y.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

SANITARY AND HYGIENIC WORKING CONDITIONS IN THE TUNNEL OF THE MEREFA-CHERSONER RAILROAD. *S. Demidowitsch. Gigiena Truda, 1927, no. 3, pp. 29–33.*

The Merefa-Chersoner tunnel had to be built by tunneling 850 meters through soft, muddy soil. The air in the tunnel had a high humidity (87 to 97 per cent.), water collected in the workplaces, conditions for natural illumination were bad, there was severe physical strain in cutting through the sticky soil, the rickety supports had constantly to be strengthened, and the air circulation was poor (0.7 meters away from the entrance it was 0.33 meters per second; at workplaces 340 meters in, 0.07 meters per second; and where excavation was going on, 0.05 meters per second).

Ventilators to provide a stronger air circulation in the workplaces in the tunnel had insufficient effect; as the humidity increased and the air velocity diminished, the effective temperature rose—varying between 13.4° and 15.7° at the place where excavating was being done. Large amounts of carbon dioxide, as well as traces of hydrogen sulphide, were found in the air. The tunnel workers put in six hours a day, yet at the end of the work period a physiologic examination showed severe fatigue.

In view of the considerable physical strain to which the tunnel workers are subjected, the author believes that the cooling effect of the tunnel air is entirely insufficient and that for a man doing heavy physical work in normal (usual) clothing the upper limit of the comfort zone should not fall above 10° on the effective temperature index.—B. A.

THE EFFECT OF DIFFERENT SYSTEMS OF LIGHTING ON OUTPUT AND ACCURACY IN FINE WORK (TYPESETTING BY HAND). *H. C. Weston and A. K. Taylor. Joint Rep. Indust. Fatigue Res. Board and Illumination Res. Com., pp. 9. H. M. Stationery Office, 1928.*

This short report describes a second investigation into the optimum illumination required for composing in the printing industry. The evidence indicates that local lighting is inferior to either direct general or semi-indirect lighting, and that this inferiority is accentuated whenever glare from the light source is present. The conclusions indicated are that the best installation for composing rooms would be either direct general lighting or semi-indirect, combined with local lighting, designed in each case to yield an illumination of about 20 foot candles on the working plane. Some evidence was also obtained that the color of the light used in composing rooms may be of importance in relation to the question of glare, but further investigation on this point is needed. The method of inquiry and the results obtained are set out in figures and tables.—E. L. C.

AERATION OF INDUSTRIAL BUILDINGS. *W. C. Randall. Jour. Am. Soc. Heating and Ventil. Eng., Jan., 1928, vol. 34, pp. 11–28.*

As a result of laboratory studies on miniature model factory buildings at the University of Michigan and also of field surveys, the author concludes that successful aeration by natural means can be induced in buildings when the force due to wind and that due to temperature difference are co-ordinated and controlled. He discusses the factors which affect the flow of air into and out of industrial buildings and the great volumes of air that can be moved by the forces of nature. He then gives experimental data by means of which the flow of air can be determined with a reasonable degree of accuracy.

Although the author regards aeration as synonymous with ventilation, he recognizes very justly that it is not a cure-all method, and that in many cases, mechanical ventilation must be resorted to.—C. P. Y.

WHAT WILL THE ENGINEER CHOOSE —HEATING ONLY OR AIR CONDITIONING FOR THE MODERN PLANT. *H. P. Gant. Jour. Am. Soc. Heating and Ventil. Eng., Jan., 1928, vol. 34, pp. 1–10.*

This is an interesting comparison of initial costs and costs of operation of the six principal types of heating and air conditioning systems used in modern industrial plants. All computations were based on an actual manufacturing plant, which was assumed to be heated to 70° F. in zero weather. In the air conditioning systems, a relative humidity of 65 per cent. was assumed, in conjunction with a temperature of 70°. The designs of the various systems were worked out by specialists chosen from different companies.

It appears that the most economical method of heating modern plants is by means of floor type unit heaters, and the most economical method of air conditioning, the self-contained air conditioning units.

In addition to his discussion of costs, the author deals with adaptability, flexibility of control, facility for expansion, conservation of floor space, obstruction of light, and other, secondary factors.

Although the author appears to favor the self-contained floor units, he recognizes that each system has its

own distinct application and that the designer should weigh all factors carefully before deciding upon any particular type.—C. P. Y.

INDUSTRIAL PERSONAL AND COMMUNITY HYGIENE: HOUSING, ETC.

THE HOUSING OF AGRICULTURAL WORKERS IN GERMANY. *Abstr. as follows from Internat. Labour Rev., 1927, vol. 15, pp. 750–752, in Bull. Hyg., Feb., 1928, vol. 3, pp. 133–134.*

The housing of agricultural workers in Germany is closely bound up with the employment of alien seasonal workers. The spread of beet cultivation increased the number of these. In 1907, there were 1,045,000 German nationals employed in agriculture, while the number of alien immigrant workers was 400,000. Since the war the German government has tried to cut down the number, ostensibly to relieve unemployment among its own nationals. For purely seasonal work it is still necessary to rely on immigrant labor, but wherever possible national labor is preferred. Housing is the principal difficulty associated with the replacement of alien by national labor. Alien laborers were content to live in barrack-like dwellings of a very poor type. Nationals demanded better houses, of which there were not sufficient. The problem of rural housing is therefore as great in Germany as in any other part of Europe. A rural building program subsidized out of funds for productive unemployment relief has been carried on since January, 1921. Up to March 10, 1925, 18,000 rural dwellings had been built. A sum of 30 million marks is now to be allocated to the scheme.

Under present regulations, two types of buildings may be put up: "industrial dwellings" and "workers' dwellings," the former built by the employer for his workers, and the latter by the individual worker for himself. The available funds cover both types and the grant may be as much as 75 per cent. of the total building cost. The loan issued to an individual worker is repayable in thirty years, instead of ten. Employers applying for a grant from the fund must show that the buildings they construct will lead to the discharge of alien workers.

At 4,000 marks per dwelling, the funds will permit of the erection of 15,000 dwellings, which will mean the replacement by national labor of between 36,000 and 40,000 alien workers. Up to March 31, 1926, 7,000 new rural dwellings had been erected in East Prussia, and the number of alien workers had fallen from about 22,000 before the war to 8,000.

It is pointed out that an industrial dwelling is "tied" and the worker does not secure an independent home. Termination of employment means loss of home. It is therefore urged that "workers' dwellings" should be encouraged. Even these are not satisfactory, because of the debt on the workers which they entail. To get over this difficulty, "workers' rural villages," self-administered, are suggested.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

THE MEDICAL ASPECT OF VOCATIONAL GUIDANCE. *A. Stocker. Internat. Labour Rev., 1927, vol. 16, pp. 618–636; 817–834.*

Vocational guidance calls for doctors to study work and workers physically and physiologically. Character in processes calls for character in workers. "Temperament" depends on constitutional or glandular equilibrium. A machine is a finite thing, but a man is always in process of becoming. Extension of the participation of doctors in vocational guidance can be traced in published articles and books, in organization of courses of instruction, in institutions for medical collaboration, and in legislation. Evidence drawn from all civilized countries is quoted to demonstrate the lines of progress. A good doctor possesses the qualities requisite for vocational guidance, but sooner or later he must become a specialist. His object must be to find suitable work for every applicant. Occupational analysis, as drawn up in America and in London, is of great help. The environment is at least as important as the process. The best training lies in visiting workshops and factories. Action is taking place differently in different countries in establishing collaboration between the medical profession and vocational guidance. Information is given concerning Austria, Belgium, France, Germany, Great Britain, Netherlands, Poland, Spain, Switzerland, and the United States. Specimens of medical record cards are given, special reference being made to the National Vocational Guidance Committee of France. So far vocational guidance is feeling its way apart from legislation, but is naturally often linked with employment exchanges; the part to be played by the doctor is still far from final settlement.—E. L. C.

PRACTICAL EXAMINATION FOR COLOR PERCEPTION. *E. Schaaff. Abstr. as follows from Arch. d'opht., Sept., 1927, vol. 44, p. 556, in Am. Jour. Ophth., Jan., 1928, vol. 11, p. 72.*

The importance of determining the amount of color blindness present in individuals from an occupational standpoint is discussed. Eight per cent. of men distinguish colors more or less imperfectly. The writer has devised a set of ten plates with the Landolt broken ring figure worked out on each in color mosaics. These charts give a rapid method of detecting not only the completely color blind but even small degrees of impairment in color perception. They are so simple that they may be used for illiterates and children.

A STUDY OF THE INCIDENCE OF THE MINOR PSYCHOSES: THEIR CLINICAL AND INDUSTRIAL IMPORTANCE. *M. Culpin. Lancet, Feb. 4, 1928, vol. 1, pp. 220–224.*

Some account is given of work done in connection with extension of an inquiry into telegraphists' cramp. The author was struck with the number of the ordinary population who displayed slight or moderate symptoms of neuroses. He worked out a few simple questions to establish the existence or absence of such a state.

Daydreaming is fairly common for workers employed at repetitive work, but is often absent where overanxiety neurosis is present. While some subjects can be placed certainly by the existence of, say, nail biting or fear of the dark, the placing cannot be reduced to a system, each subject must be judged. The McDougall-Schuster dotting machine was found of great value as a test which showed fairly close correlation with psychologic findings. Some types recognized at personal interview are quoted at length. The obsessional subject as revealed by the dotting test was found to give excellent dotting results, even though every obsessional subject does not make a good score. Nevertheless, a most important observation was that all exceptionally good records were made by obsessional subjects. The test is certainly of value. The existence of a high proportion of persons with minor psychoses in some occupations may not affect sickness rates, but in others may be the cause of considerable lost time through a variety of illnesses, the foundation of which may not at first be obvious. No active selection of particular occupations by psychoneurotic people was detected, except in the case of art students. The conclusion is drawn that the "causes" of psychoneurotic illness, like the "causes" of neuroses, are merely factors exacerbating a previously existing condition. Possibly if the psychoneurotic were excluded from occupations in which neuroses are known to occur, the incidence of these troublesome complaints would be greatly diminished, if not abolished. —E. L. C.

MALINGERING

A New Method of Detection of Simulated Blindness or Amblyopia of One Eye. *H. Lauber. Abstr. as follows from Klin. Monatsbl. f. Augenh., 1927, vol. 78, Supplement, p. 197, in Am. Jour. Ophth., Jan., 1928, vol. 11, p. 70.*

The patient is placed before the vertical perimeter, a prism of sixteen or twenty degrees apex up before the alleged blind eye, apex down before the other eye. The test object is held at the lower end of the perimeter and the patient asked to indicate its appearance from below. If it is seen very peripherally, *e.g.*, at seventy degrees, the alleged blind eye is seeing. For testing the horizontal meridian the prisms are placed base out. The patient sees crossed double images, and may convince himself of it by closing one eye. If, *e.g.*, the right eye is said to be blind he knows that he must not see the left point of fixation. If the test object is moved from the right side towards the median line, it appears at first near the right point of fixation, which the patient knows is seen with the left eye. He will not hesitate to indicate the appearance of the object, but has betrayed himself because he can see the object only with the right eye. For the double images are so far apart (eighteen degrees) that that of the right eye appears to the right of the point of fixation of the left eye.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

FIFTY YEARS OF LEGISLATION ON OCCUPATIONAL DISEASES IN SWITZERLAND. *W. Lauber. Abstr. as follows from Internat. Labour Rev., Oct., 1927, vol. 16, pp. 472–486, in Am. Jour. Pub. Health, Jan., 1928, vol. 18, p. 109.*

During the last forty or fifty years the principle of occupational risk has been successively adopted by the legislative systems of almost all countries. While this applies to accidents, in most countries no compensation is payable for industrial poisons or infections. The experience of Switzerland, the first country to adopt occupational disease legislation, now covers half a century. Its principle was first applied to the manufacture of matches with white phosphorus and the use of Jacquard looms with lead weights.

An historical survey shows that the schedule method was early adopted, in 1901, thirty-four disease hazards being listed. In September, 1920, the list was extended to over 100 disease causes, principally poisonous substances. (The article discusses at some length the legal provisions adopted in regard to occupational diseases in Switzerland.)

MASTER AND SERVANT. WORKMEN'S COMPENSATION. INDUSTRIAL DISEASES. THE WORKMEN'S COMPENSATION (INDUSTRIAL DISEASES) ORDER, 1927, DATED APRIL 30, 1927. *Statutory Rules and Orders, 1927, No. 386, pp. 2. H. M. Stationery Office, 1927. Abstr. as follows in Bull. Hyg., Feb., 1928, vol. 3, p. 165.*

These Rules and Orders extend the provisions of Section 43 of the Workmen's Compensation Act to such diseases as subcutaneous cellulitis or acute bursitis arising at or about the knee and known as "beat knee," and also to subcutaneous cellulitis or acute bursitis over the elbow known as "beat elbow," both injuries being sustained in the mining process.

MASTER AND SERVANT. WORKMEN'S COMPENSATION ACT, 1925. THE METAL GRINDING INDUSTRIES (SILICOSIS) SCHEME, 1927, DATED APRIL 30, 1927. *Statutory Rules and Orders, 1927, No. 380, pp. 9. H. M. Stationery Office, 1927. Abstr. as follows in Bull. Hyg., Feb., 1928, vol. 3, p. 165.*

These Statutory Rules and Orders between Master and Servant are chiefly interesting from the Workmen's Compensation Act point of view. They only interest the student of preventive medicine because they refer to industries where dust is evolved such as in the grinding of metals or any work incidental to grinding and glazing, when such work or glazing is carried on in the same room as such grinding. Association between silicosis and tuberculosis also interests the sanitarian; but the remainder of the Rules and Orders deals with questions of compensation and how such are to be settled.

J. I. H.
June, 1928

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

ANNUAL REPORT OF THE ONTARIO DIVISION OF INDUSTRIAL HYGIENE. *J. G. Cunningham. Abstr. from Ann. Rep. Ontario Dept. Health, 1926, pp. 18–23, in Am. Jour. Pub. Health, March, 1928, vol. 18, pp. 369–370.*

Sickness and accidents are responsible for at least 75 per cent. of all absence from work. The employer pays directly for accidents in Ontario $7,000,000 or $8,000,000 a year. He also pays for sickness which costs several times as much.

A booklet has been prepared by the Division for distribution: "Occupational Diseases: A Ready Reference Manual." Physicians are using more extensively the Division laboratory. Among the chief occupational diseases discussed are those due to lead, which is mostly of concern in storage battery plants, but the general conditions are very favorable in Ontario in this industry since the large manufacturers have made provisions for periodic physical examinations. Lead mining was found to have a few mild cases of lead poisoning. Lead sulphide is the form of ore. Ethyl gasoline is another possible source of lead poisoning which is being watched.

During 1926, in northern Ontario quarries 1,040 miners were given a physical and X-ray examination. In April, 1926, the Workmen's Compensation Act of Ontario was amended to

include silicosis, and since that date ninety-seven cases have been compensated. To cope with this condition steps are being taken to examine all men employed underground at sufficiently frequent intervals to hold the disease in check.

So far, the Division has received reports of fifty cases and three deaths from caisson disease which have been compensated.

A study has been made of nickel rash in electroplating rooms and a quite satisfactory disinfectant has been found, to be used with cutting compounds and cutting oils. In one large iron and steel plant no cases occurred for a period of six months after the use of the disinfectant was started.

Ventilation studies have been made in paper plants and in cotton and wool plants, also in two schools in Hamilton.

As a result of work which has been done in the reduction of infection following injuries, a plant previously notorious for the number of infected injuries, employing 800 men for the year 1926, among 1,472 cases of injury had only seven infected cases, which caused a loss of sixty-eight days and a cost of $285.

Cyanogen chloride is being used for fumigation of bunk houses as a safer disinfectant than hydrocyanic acid, since the former has a tear-gas effect which serves as a warning.

INDUSTRIAL HYGIENE IN GERMANY, BELGIUM AND GREAT BRITAIN. *Internat. Health Year-Book, 1927, pp. 723–739. League of Nations, 1927.*

Germany.—The position in Germany is stated by Dr. Leymann who details laws and decrees passed during the year by the Reich and separate states. Details are given of notifications of industrial diseases; lead poisoning stood easily top with 2,781; among other cases, benzol compounds claimed 145, glass makers' cataract 101, skin cancer fifty-nine, and Schneeberg's pulmonary disease six. In the great majority of cases incapacity ceased within the period for which compensation is paid. Action was taken to limit all overtime in certain industries involving special danger to life and health. Investigations were made, among other things, into pneumonokonioses among stone and china workers, the effects of dinitrophenol, dust in metal grinding works, eye tests for glass blowers, and occupational deafness. There were 680 factory inspectors, including eight doctors.

Belgium.—A short résumé is given by Dr. Glibert of new legislation with regard (1) to personal cleanliness in dangerous processes and to the heating of workrooms, (2) to the destruction of rodents by hydrocyanic acid, and (3) to the use of white lead in paints. Concerning the last, no paint containing white lead may be sold to private persons, or indeed used indoors, while its use without is subject to supervision, and dry rubbing down is prohibited. A law was also passed granting compensation for occupational diseases as determined by a technical advisory committee. Payments are made from a central fund gathered from employers' contributions fixed according to a scale of risks. No payments are made for a period less than fifteen days.

Great Britain.—For this country the position is set out in greater detail by Dr. Collis who gives résumés of admin-

istration of the Factory and Mines Acts. Of particular interest is an increase in cases of skin cancer related to contact with products of coal distillation, such as pitch, tar, and mineral oils. An advance in the standard of first aid appliances in factories is noted and the impending appointment of a medical inspector to bring the appliances in mines up to date. Useful tables appear of compensation claims for diseases, of which the coal miners monopolize by far the largest number, for such troubles as nystagmus (11,156 cases), beat knee (2,787), and beat hand (1,354), compared with 390 claims for dermatitis and 381 for lead poisoning. References are also made to the investigations of the Industrial Fatigue Research Board, particularly in regard to the influence of the personal factor on accident prevalence; to the appearance of the new journal, *Bulletin of Hygiene;* to the expanding work of the National Institute of Industrial Psychology; to the formation of a Council of Industrial Medicine; to the successful invasion from Scotland of England and Wales by the Industrial Health Education Society which at lecture meetings carries knowledge to craftsmen and workers; and to the continued activities of the Industrial Welfare Society and the Institute of Industrial Welfare Workers.—E. L. C.

ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF THE UNITED STATES FOR THE FISCAL YEAR 1927. *Government Printing Office, 1927, pp. 355. Abstr. in Am. Jour. Pub. Health, Feb., 1928, vol. 18, pp. 227–228.*

The Office of the Surgeon General under the direction of Surgeon L. R. Thompson has conducted investigations of tetraethyl lead, occupational health hazards, occupational diseases, and industrial absenteeism.

Four of the seven dust studies being conducted by the Service have been completed, as follows: cement, granite, hard coal mining, and polishing and buffing of silverware. It would appear that every aspect of the problem of dust inhalation has received careful and detailed consideration in these studies.

The Office of Industrial Hygiene has been interested in the problem of illumination for some time, and during the past year, in order to study the problem of distribution of daylight within factories and schoolrooms, an experimental illumination cabinet in the form of a building 30 feet square and about 16 feet high has been constructed in Arlington County, Va. Window space, ceiling height, and floor area may be altered at will, and it is proposed by means of illumination readings continued throughout the year to obtain fundamental data on the distribution of natural illumination in buildings.

In order to study the problem of smoke pollution of the atmosphere and the loss of light due to smoke, daylight illumination recorders were installed, one on the lower end of Manhattan Island where the air is heavily polluted and one on one of the buildings on Hoffman Island where the air is comparatively free from dust and smoke. So far but two months' records are available but these show a large absorption of light by the atmospheric pollution depending upon the time of day and sky conditions.

The Service has published a very valuable paper on the problem of

posture, and an exceedingly valuable bibliography on the literature on this subject has been published in the *Public Health Reports.*

Studies on occupational dermatoses, pneumonia among steel workers, industrial absenteeism, and illumination in post offices, and co-operation with the Bureau of Standards and the Bureau of Mines have been continued throughout the year.

SOME RELATIONS OF MEDICINE TO INDUSTRY. *C.-E. A. Winslow. N. Y. State Jour. Med., Nov., 1927, vol. 27, p. 1246.*

Dr. Winslow takes as his text a passage from Thackrah outlining the problems of industrial hygiene early in the nineteenth century and considers the progress which has been made in the century which has passed. He outlines the part played by the Workmen's Compensation Act in furthering accident prevention and industrial medical service and discusses in particular the present situation with regard to lead poisoning, benzol poisoning, and silicosis.

"The true industrial physician," Dr. Winslow considers, "should not only practice minor surgery and render first aid in factory illness and make physical examinations of prospective employees. He should also be familiar with the industry itself, should take an active part in the control of its poisons and dusts and other hazards and should be a specialist in the complex problem of adapting the individual worker from a physiological and a psychological standpoint to the particular task which he is to perform."

In closing, he states that "the control of industrial disease depends, not alone upon the factory physician however competent, but involves the intelligent cooperation of the medical profession as a whole."—M. C. S.

RECENT WORK IN THE FIELD OF INDUSTRIAL HYGIENE. *G. Wolff. Chem.-Ztg., vol. 51, no. 93; Fortschrittsber., 1927, pp. 118–120.*

CONTRIBUTION OF INDUSTRY TO PUBLIC HEALTH. *S. M. McCurdy. Ohio State Med. Jour., Dec., 1927, vol. 23, p. 995.*

WORKING CONDITIONS IN POLISHING CASTINGS. *O. Leschtschinskaja. Gigiena Truda, 1927, no. 4, pp. 18–24.*

The author investigated twelve plants in the Ukraine where polishing of castings was done for the most part without machines. There were no women or young persons among the buffers.

Dustiness of the air where the molds were emptied out varied with the extent to which the castings were cooled. Thus where they had been cooled the dust content averaged 69.6 mg. per cubic meter of air in one establishment; in another, 81.3. Sulphur dioxide in one plant (during the night shift) was found in amounts of 727.5 mg. per cubic meter of air; in another, 382.3 mg. Such a difference is due to the fact that the first establishment produced far greater amounts of castings, and to the fact that the drying ovens were possibly defective. Traces of hydrocyanic acid were also found.

Analysis of the air in the rooms where the edges were trimmed showed a high dust content, averaging 100 mg. per cubic meter of air. Microscopic

examination of the dust, which consisted of iron and silicates, showed that 83.9 to 94.4 per cent. of the particles were less than 10 microns in diameter. —B. A.

WORKING CONDITIONS IN THE "ROSA LUXEMBURG" COTTON WADDING FACTORY IN SVERDLOVSK. *M. Sviderskaja. Gigiena Truda, 1927, no. 5, pp. 48–53.*

The author describes the work processes in the separate departments of the factory, the atmospheric conditions, and the results of examinations of the air in the workrooms with regard to dust content.

In the wool carding room the temperature varied between 13.5° and 18.5°C.; the relative humidity, between 70 and 72 per cent. During the loading of the machine, dust was present in the breathing zone of the women workers in amounts of 68 mg. per cubic meter of air; during the unloading, in amounts of 44 mg.

In the wool picking room the temperature was 20° to 23°C.; the humidity, 72 per cent. Heat loss was insufficient and the comfort index was high under the working conditions, being 17 and 21.5, presumably on the effective temperature scale. Dust was present in amounts of 43 mg. per cubic meter of air.

In the swingling room atmospheric conditions were favorable as compared with other departments in the factory. During operation of the wool carding machine 56 mg. of dust per cubic meter of air were found and while loading the swingling machine 88 mg. of dust were present at the height of the woman operator's head.

Atmospheric conditions in the wadding and packing departments were almost normal, according to the workers. In the wadding department during operation of the combing machine dust was present in amounts of from 43 to 48 mg. per cubic meter of air; in the packing department, in amounts of only 5 mg.—B. A.

WORKING AND HEALTH CONDITIONS IN FILE CUTTING ESTABLISHMENTS. *W. Weisbach. Zentralbl. f. Gewerbehyg., June, 1927, N. S. vol. 4, pp. 215–219.*

On the basis of dust determinations in six establishments and of blood examinations and study of statistical records of file cutters, the author concludes that there is no special lead hazard in the trade. He considers the work strenuous, however, and states that rheumatic diseases are common, especially among the polishers.

A detailed description of file cutting processes, together with illustrations, is given.—M. C. S.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

THE CANCER OF CHIMNEY SWEEPS. ITS HISTORICAL, CLINICAL, AND PATHOLOGICAL FEATURES. *F. Bang. Bull. de l'assoc. franç. pour l'étude du cancer, July, 1927, vol. 16, pp. 656–687.*

This is an interesting article written by a foreign authority on cancer, discussing what England can unfortunately claim as a peculiarly grave English occupational disease. Its social aspect is reviewed and the efforts of Hanway, Shaftesbury, and

others to lessen the hardships of the "chimney sweeping" boys is duly chronicled. The character of chimney sweepers' cancer was discovered and described by Percival Pott in 1775. He regarded it as being caused by soot. Boys between 8 and 12, Pott says, were "thrust up narrow and sometimes hot chimnies, where they were bruised, burned and almost suffocated; and when they got to puberty, became peculiarly liable to a most noisome, painful and fatal disease."

England was not the only country in which boys were sent up chimneys which required sweeping. Youths from the mountains of Saboz came every winter into Paris, likewise boys from the hills of Italy, being expert climbers, came into the towns regularly to do this work, but cancer of the scrotum was unrecognized. In Belgium and Germany this trade was carried out in the same way, children of 4 years of age being pressed into the service. In Scotland, France, the United States of America, Belgium, Vienna, and Prague, Bang says, chimney sweeps are exposed to very similar conditions, but only in England was chimney sweeps' scrotal cancer at all frequent. A few exceptional cases have been recorded by German writers (Baum, Rosser) and one or two are mentioned among the chimney sweeps of Savoy (Rouge). From the German statistics of 1904 to 1908, one learns that the occupation of a sweep is considered to be quite healthy (Weyl). In Copenhagen young boys today climb inside the chimneys, to sweep the flues of old houses, but cancer is unknown. Bang informs us that in Denmark "sweeps" change their clothes and take a daily bath.

In England in 1840 youths under 21 were forbidden to enter the chimney flues. Since then the deaths from cancer have diminished. Even at the present time, however, deaths from malignant diseases, in this occupation, are double those found in other trades. Its most common site is the scrotum. This situation, as Bang suggests, is specially prone to be attacked by irritation due to soot, tar, and paraffin. England is apparently the only country which burns coal on the open hearth, and to the tar disengaged with the soot this authority would blame the special prevalence of this occupational disease in England.

This article by Bang is very well docketed and is the most complete recent review of the subject known to the abstracter. It reminds us of the difficulties which are met with by those who are urging industrial reform. It intimates that scrotal cancer is practically nonexistent, apart from the irritation from certain products of the distillation of coal petroleum and perhaps arsenic. It thus becomes an indication of some improper exposure to one or other of these substances. Cancer from tar was first recognized by Anatole Manouvriez in 1876; Volkmann noted paraffin malignancy in 1875, and cancer of the bladder was primarily recorded by Renn in 1895; all had an occupational origin.—R. P. W.

CASE OF CHIMNEY SWEEP'S CANCER. *G. Guldberg. Abstr. as follows from Norsk Mag. f. Laegevidensk., Nov.-Dec., 1927, vol. 88, p. 1131, in Jour. Am. Med. Assn., Jan. 28, 1928, vol. 90, pp. 337–338.*

The first known case of chimney sweeps' cancer in Scandinavia is

contributed by Guldberg: A chimney sweep, aged 60, had a prominent infiltrative tumor of hazel nut size on the under side of the scrotum with crater-shaped ulceration on its surface, the rest of the scrotal skin being the seat of multiple papillomas and chronic dermatitic changes. No glandular metastases were detected. In 4,612 cases of cancer, 157 occurred in patients less than 30 years of age, eleven of these were between the ages of 8 months and 15 years. Of the 157 cases, fifty-three were in the female genitalia, twenty-four in the digestive tract, and nineteen in the skin. Cases of cancer in the digestive tract, in the skin, and in the kidneys are reported.—K. R. D.

Systemic Factors in Genesis of Tar Cancer. *L. Kreyberg. Abstr. as follows from Brit. Jour. Exper. Path., Oct., 1927, vol. 8, p. 352, in Arch. Dermat. and Syph., March, 1928, vol. 17, p. 416.*

Experimental evidence is presented by Kreyberg which indicates that tar, directly or indirectly, through a systemic factor, influences the skin of white mice, with the result that the incidence of tumor after a certain local insult is increased.

Scrotal Cancer in Cotton Mule-Spinners. The Late Dr. S. R. Wilson's Observations. *Brit. Med. Jour., Nov. 26, 1927, vol. 2, pp. 993–994.*

Interesting extracts are reproduced from an essay written as long ago as 1910 by the late Dr. S. R. Wilson, in which he set forth for the first time the facts proving the existence of scrotal cancer as an occupational disease among mule spinners in the cotton trade. A series of forty cases is instanced with their ages; and the condition is bracketed with skin cancers occurring among chimney sweeps, and tar and paraffin workers. The causation is discussed from the possibility of being due to mechanical irritation, to dust, to grease, to some constituent of the cotton, or to repeated traumatism. The clinical course is described, commencing with a wart which in most instances underwent malignant ulceration within twelve months. The notes conclude with a statement of the present position by Dr. E. M. Brockbank, for which his letter to *The Times* (see This Jour., 1928, vol. 10, Abstr. Section, p. 57) may be consulted.—E. L. C.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

Conditions of Work and Occupational Diseases in the Roofing Paper Factory in Rostov a. D. *V. Montikova. Gigiena Truda, 1927, no. 5, pp. 57–58.*

An investigation of eighteen workers in this roofing paper factory showed the presence of characteristic pathologic conditions in the upper respiratory passages, in the organs of hearing (see following abstract) and of sight, and in the skin tissue. Examination of the eyes showed a clearly defined chronic conjunctivitis and, in four cases, a definite hyperemia of the papilla of the visual nerve, due to the effect of naphthalene fumes. On the uncovered portions of the body and

on the face the workers feel an itching and burning sensation which is especially severe on exposure to the sun's rays; the skin is pigmented and on the upper arms patches of acne and folliculitis can be observed. All these conditions the author ascribes to the irritative effects of the fumes from the tar and pitch used to saturate the paper in manufacture of the roofing.—B. A.

THE CONDITION OF THE AUDITORY ORGANS AND OF THE UPPER RESPIRATORY PASSAGES IN WORKERS IN A ROOFING PAPER FACTORY. *I. M. Krukover. Gigiena Truda, 1927, no. 5, pp. 58–60.*

Ten workers in a roofing paper factory, who were between 25 and 40 years of age and had worked there for from one to four years, were given a detailed otolaryngological examination. All showed chronic diffused inflammation of the upper respiratory passages with atrophic appearances of hyperplastic mucous membrane. All showed injury to the tone giving and tone receiving apparatus as well as an increased irritation of the vestibular apparatus; all had ringing in the ears. The fatigue limit of hearing averaged 4 to 5 inches.

The author believes that the hyperplasia of the mucous membrane and the atrophic condition in the upper respiratory passages are due to the effect of the poisons used in the manufacture of the paper (benzol, hydrogen sulphide, carbon monoxide, ammonia, etc.), and that diffusion of the inflammation from the mucous membrane of the nose and throat to the cavity of the middle ear can cause injury to the auditory apparatus.—B. A.

OCCUPATIONAL POISONING IN THE DISTRICT OF MOSCOW, 1925 TO 1926. *V. Tschetverikov. Gigiena Truda, 1927, no. 5, pp. 36–44.*

During 1925 and 1926 in the district and in the city of Moscow 485 cases of occupational poisoning were recorded. The largest number of these cases of poisoning was caused by carbon monoxide (226 cases, or 46.6 per cent.); ninety-three (19.1 per cent.) were due to dinitrochlorobenzol, thirty-five (7.2 per cent.) to lead, twenty-nine (6 per cent.) to hydrogen sulphide, and twenty-seven (5.6 per cent.) to aniline.—B. A.

A NEW APPARATUS FOR AUTOMATICALLY RECORDING THE AMOUNT OF COMBUSTIBLE VAPORS (BENZINE, BENZOL, ETHER, ETC.) IN THE AIR. *Eibel. Abstr. as follows from Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 291–293, in Bull. Hyg., March, 1928, vol. 3, pp. 236–237.*

The apparatus, which is made by the Union Apparatebau-Gesellschaft in Karlsruhe, Baden, is likely to prove useful in preventing explosions from mixtures of air and inflammable vapors. Contacts can be so arranged as to ring a bell as a signal when the danger point in the proportions present in the air is approached.

The principle on which the apparatus is based is the measurement of the difference of the viscosity of gases in comparison with their specific weight.

EVIDENCES OF POISONING IN WORKERS AT THE BLAST FURNACES OF METALLURGIC PLANTS. *S. Aranovskij. Gigiena Truda, 1927, no. 5, pp. 28–36.*

Blast-furnace gas (composed of

carbon dioxide, carbon monoxide, hydrogen, nitrogen, and methane) is produced in large amounts by blast furnaces and escapes into the air, owing to insufficient ventilating apparatus as well as to conditions of work when the flues are being cleared from dust. Frequent coal gas poisoning of the workers is thus caused. At the metallurgic works of Dnepropetrovsk the cleaners and helpers were afflicted with coal gas poisoning more than other workers, followed by the men in the shops and the mechanics. It was observed that with the employment of new, unskilled workers the number of cases of poisoning increased. The author recommended a series of measures to prevent the poisonings. With the installation of a new blast furnace these measures were put into practice and gave good results, the coal gas poisonings ceased and at the same time the productivity of the furnace increased.—B. A.

A Simplified Method for the Quantitative Determination of Carbon Dioxide, Ammonia, and Hydrogen Sulphide in the Air of Inhabited Rooms. *K. Süpfle, P. Hofmann, and L. Walz. Arch. f. Hyg., 1927, no. 4–5, pp. 147–157.*

The authors were not able to use Lehmann's method for the determination of hydrogen sulphide which depends upon the reduction of iodine solution and subsequent titration with sodium thiosulphate, owing to the fact that the latter solution absorbed part of the carbon dioxide. A type of apparatus was therefore evolved in which hydrogen sulphide was absorbed by pumice stone treated with copper sulphate—the gain in weight representing the hydrogen sulphide absorbed. Room air was drawn through an absorption apparatus by means of a small electrical pump, the ammonia absorbed in 0.1 normal sulphuric acid, the moist air next dried over calcium chloride and passed over the pumice stone-copper sulphate absorption material to absorb hydrogen sulphide, then through a carbon dioxide absorption flask, and finally over calcium chloride again.

The technic of determining these substances is described and the application of the methods to field use discussed.—L. T. F.

(1) CO-Hyperglycaemia in the Bilaterally Splanchnectomized Rabbit. *S. Mikami. Tohoku Jour. Exper. Med., 1927, vol. 8, pp. 113–128.*

(2) On the Influence of Administration of Some Alkalis upon CO-Hyperglycaemia in Rabbits. *S. Mikami. Ibid., pp. 129–141.*

(3) Simultaneous Determination of the Blood Sugar Content, and the Gas Content and Alkalinity of the Arterial Blood during Carbon Monoxide Poisoning. *S. Mikami. Ibid., pp. 237–277.*

(4) Effect of Insulin upon the CO_2 Content in the Arterial Blood and the Blood Sugar Level in Rabbits Poisoned by Carbon Monoxide. *S. Mikami. Ibid., pp. 278–283.*

Abstracted as follows in Physiol. Abstr., Feb., 1928, vol. 12, p. 638.

(1) Carbon monoxide administered hypodermically, intraperitoneally, or by inhalation causes hyperglycemia and glycosuria in normal rabbits. The effect is markedly lessened by bilateral splanchnectomy, and was only obvious with severe carbon monoxide poison-

ing. (2) Carbon monoxide hyperglycemia and glycosuria in normal rabbits is diminished by sodium bicarbonate, sodium carbonate, disodium phosphate, and caustic soda when given intravenously. (3) Concurrently with the rise in blood sugar there is a diminution in hydrogen ion concentration which runs parallel, but in reverse direction to the hyperglycemia. There is also a parallel fall in oxygen content, and a slower fall in carbon dioxide content in the arterial blood. In acute and rapid death from carbon monoxide poisoning the only variable is the oxygen, which falls very low. The smaller doses, which do not kill, cause tachypnea. This tachypnea is independent of the integrity of the vagi. Alkalies which inhibit the hyperglycemia also inhibit the carbon dioxide reduction, but have no action on the oxygen content of the arterial blood. (4) Insulin can inhibit the hyperglycemia, and also the carbon dioxide reduction due to carbon monoxide poisoning.

Pathologic Anatomy of Acute Carbon Monoxide Poisoning. *F. Leoncini. Arch. di antropol. crim., Sept.–Oct., 1927, vol. 47, p. 807.*

Casuistic Contribution to the Clinical Manifestations of the Psychoses Following Carbon Monoxide Poisoning. *E. Mattauschek. Wien. med. Wchnschr., 1927, vol. 77, pp. 1239–1240.*

Resuscitation Methods in Carbon Monoxide Asphyxia. *M. R. Mayers. N. Y. State Dept. Labor, Indust. Hyg. Bull., Sept., 1927, vol. 4, pp. 9–11.*

This article summarizes present knowledge with regard to the chemical and physiologic reactions produced in the body by carbon monoxide, the distinction between carbon monoxide asphyxia and asphyxia due to electric shock, and methods used for resuscitation. When artificial respiration must be resorted to, two sets of factors have to be considered: the method, that is, whether it is to be manual or applied by an apparatus, and, secondly, the chemical agent to be used in connection with either of these methods. The Schäfer manual method is recommended as more nearly approximating the normal physiology of respiration than the use of apparatus and as being far more safe in the hands of the inexpert. Positive pressure resuscitation apparatus, using a mixture of oxygen plus 5 per cent. carbon dioxide, are recommended "in the hands of those who know how to put them to proper use."—B. A.

Carbon Monoxide Tests in Commercial Garages and Automobile Repair Shops. *C. M. Salls. N. Y. State Dept. Labor, Indust. Hyg. Bull., Nov., 1927, vol. 4, pp. 17–20.*

Data are presented giving the results of 121 tests for carbon monoxide in seventy-one storage rooms and workrooms. The Sayers-Yant method of estimation as used is described and illustrated.

The average of all carbon monoxide tests was 0.9 part per 10,000, *i.e.*, less than 1 part per 10,000. The average for repair shops was 1.1 parts per 10,000; for rooms in which small repairs were made incidental to the storage of automobiles, the average was 0.6 part per 10,000; and in com-

mercial garages storing five or more cars the average was 0.9 part per 10,000.

One part per 10,000 is cited as being "just about the maximum that should be tolerated in a room where there is an eight hour exposure to the gas." Two workrooms in automobile repair shops showed tests as high as 3.2 and 3.8 parts per 10,000, "a concentration range that is dangerous when the exposure is more than one hour." In a total of seventy-one workrooms, twenty-seven showed more than 1 part per 10,000. In other words, an excessive quantity of carbon monoxide was found in 38 per cent. of the rooms, or considerably more than one room out of three on the average revealed an intolerable condition. For twenty-seven rooms showing concentrations in excess of 1 part per 10,000, the average concentration was 1.5 parts per 10,000.

No correlation could be established between excessive carbon monoxide concentration and open window area. There was an exhaust system in only one of the seventy-one shops. In five, small propeller fans were installed in windows, and in the remaining sixty-five there was no mechanical ventilation. A few of the shops were equipped with flexible pipes which were slipped over the end of the exhaust pipes to conduct the noxious gases outside the building.

Many of the garage proprietors reported that employees complained of headaches which they believed were caused by the gas; but there were only a few places where the condition became so pronounced that employees had to leave their work.—B. A.

CARBON MONOXIDE POISONING IN COAL MINES. *B. Weissberger. Wien. klin. Wchnschr., Dec. 22, 1927, vol. 40, pp. 1605–1607.*

The author gives the histories of sixteen cases of illness among men working in a mine in which there had been a severe explosion about two months previously. Gas masks were necessary on account of the presence of irrespirable gases. Each man worked for four hours, with a two-hour pause after two hours of work.

The symptoms were extremely varied but the nervous system and the blood vessels seemed uniformly to be affected. Headache, general weakness, and increased blood pressure appeared first; later monoplegias developed, such as monoplegia of the face, and in one case there was hemiplegia with paralysis of speech; still later a typical multiple sclerosis and cardiac neurosis were observed in some cases. There were also cases in which hemorrhages into the subcutaneous connective tissues, the retina, and the stomach occurred.

At first the etiology was not clear, and these cases were thought to have been caused by unaccustomed work with a gas mask. The symptoms and the course of the illness, together with the autopsy findings, in one case which is reported in considerable detail led to the diagnosis of carbon monoxide poisoning. Various references from the literature are cited in support of this diagnosis.—M. C. S.

INDUSTRIAL POISONING FROM HYDROCARBONS OF THE AROMATIC AND ALIPHATIC SERIES (CHLORINATED HYDROCARBONS), AND ITS PREVENTION. *Floret. Zentralbl. f. Gewerbehyg., Aug., 1927, N. S. vol. 4, pp. 257–261; Oct., 1927, pp. 369–372.*

Floret, who is physician in charge of the great chemical and dye works at Elberfeld, treats of some well-known and some less familiar compounds of these two series which are of such great importance in industry. Their toxic action rests on the property common to all of dissolving fats, including lecithin and cholesterin, and is in proportion to this power and to their insolubility in water. Because of the abundance of fat in the central nervous system their action is chiefly exerted there. The skin and the respiratory tract are the portals of entry; lungs, skin, and intestinal tract excrete these bodies practically unchanged. Many of the members of the aliphatic series are practically inert, while some of the members of the aromatic series are highly toxic. The characteristic effect on the nervous system is: excitement, confusion, anesthesia; on the skin and mucous membranes: dermatitis, eczema, conjunctivitis, pharyngitis. Certain ones have a special action on the liver, or blood, or blood building tissues. In industry, mixtures are used which contain members of both series.

Methane and its homologues are nontoxic but acetylene, itself harmless, has in industrial use given rise to serious poisoning because of its contamination with hydrogen phosphide. Of the chlorinated compounds of the aliphatic series, Floret regards carbon tetrachloride as not dangerous, Lehmann having shown that man has a high degree of resistance to it. Anesthesia from the fumes passes over without sequela. No mention is made of the irritating effect on the bronchi, or of the marked liver necrosis found in animals (Evarts Graham), or of the important fact, established by Fieldner and Katz, that the use of carbon tetrachloride as a fire extinguisher in enclosures with a poor supply of air results in the production of phosgene. Tetrachlorethane, far more toxic, is described in detail. The methane derivatives are less harmful than the ethane, the ethylene taking a place between. Toxicity decreases as the number of chlorine atoms increases (see to the contrary Evarts Graham: Jour. Exper. Med., 1915, vol. 22, p. 48).

Germany uses chiefly Pennsylvania petroleum, which consists mostly of aliphatic hydrocarbons, in contrast to the Russian or Caucasian, which is rich in aromatic bodies, and therefore much more toxic. Nevertheless, serious, even fatal poisoning may occur in refineries and distilling plants where the aliphatic compounds are handled. The symptoms of poisoning due to benzine derived from the petroleum are those of a pure central nervous system poison, with effect on the vasomotors, as shown in the cold, cyanotic skin and muscular tremors without lowering of body temperature. The nervous symptoms may include epileptiform convulsions and in women these may persist for some time after. Floret describes such a condition in a young girl which lasted for a year after an acute poisoning from benzine fumes. Chronic poisoning is characterized by psychic depression, pains in limbs, digestive disturbances, a picture resembling chronic carbon disulphide poisoning. A fatal case in a man who was filling cans of benzine is described. He became suddenly unconscious, and later there were symptoms suggestive of meningitis,

pains in the neck and head and stiffness of the neck, great restlessness, albuminuria, and high fever. After a few days an erysipeloid eruption appeared over the buttocks which became necrotic, and similar areas appeared in the mouth and throat. Floret believes that these were caused by the excretion of benzine through the skin. The man died in the fifth week after the accident.

There is a section on the skin diseases caused by the heavier aliphatic compounds, tar, pitch, paraffin, and finally one on benzol and its homologues, in connection with which Floret recounts an extraordinary observation made by him during the war in a group of women benzol workers who presented the appearance of blooming health in spite of the scarcity of food and in decided contrast to other women workers. The blood had a high hemoglobin content and an abnormally high white cell count. In spite of close observation no injury from the benzol could be detected.

Floret considers the chlorobenzols still more strongly narcotic than benzol and they have an irritating effect on mucous membranes. (This is in decided opposition to the experience of American industrialists who find benzol the real danger in the production of chlorobenzols.) The new compounds, tetralin, hexalin, and methylhexalin, which are produced by catalytic reduction of naphthalene and phenols and are used in making soap and as solvents for lacquers, are found by animal experiments to be practically harmless.—A. H.

CONTRIBUTIONS TO THE TOXICITY OF THE AROMATIC NITRO COMPOUNDS: NITROPHENOL. *Koelsch. Zentralbl. f. Gewerbehyg., Aug., 1927, N. S. vol. 4, pp. 261–268.*

Conflicting views on the toxicity of the nitrophenols, held by some to be very marked, by others very slight, led Koelsch to study them, especially dinitrophenol. This is a report of his experiments and of those of Lehmann and Schmidt which appeared about the same time, and a review of the non-German literature.

Six isomers of dinitrophenol are known, differing in chemical, physical, and physiologic properties. The first fatalities reported came from the German chemical industry when in 1902 Leymann saw three cases of suddenly developing acute poisoning, with collapse, fever, convulsions, dyspnea, tachycardia, and death a few hours later. During the war there were several cases in England, with one death, but a far larger number in France where dinitrophenol was used on a large scale as a constituent of the explosive melinite. Up to August, 1916, there were twenty-seven deaths in seven factories and in the following year eleven cases with two deaths. The poison gains entrance through inhalation of fumes and dust and by way of the skin, and also to some extent by way of the intestinal tract.

According to French experimenters, A. Meyer and E. Martin, the mechanism of intoxication consists in an enormous increase in the intracellular oxidation processes, with consequent increase in gaseous exchange (up to ten or twelve times the normal) and rise in body temperature (in animals, up to 45°C. before death) in spite of the dilatation of the skin capillaries

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and profuse sweating. This excessive oxidation has its effect on metabolism and nutrition and produces damage to liver and kidney cells. Both unchanged dinitrophenol and reduction products (aminonitrophenol and diaminophenol) are found in the urine. Lutz and Baume found acute hemorrhagic nephritis in dinitrophenol poisoning.

There was evidence of a marked individual idiosyncrasy in the French cases; alcoholics were very susceptible; hot weather increased the danger especially for those susceptible to heat; there was some acquired immunity to small doses but not to large doses.

Lehmann and Schmidt in Germany and Meyer in France found that herbivorous animals were much more resistant to dinitrophenol than were carnivorous animals. Koelsch used cats for his experiments and chose the isomer which is of importance in the chemical and explosive industry, ortho-para-dinitrophenol 1-2-4. This he administered by mouth, by inhalation, and by skin. The first method was the only one yielding accurate results. He found that 0.05 gm. per kilogram of body weight given by mouth proved fatal in one hour and a half with symptoms of suffocation, death being followed almost instantly by rigor mortis and clotting of the blood. The organs were hyperemic and the kidney cells damaged. Koelsch believes the early rigor mortis to be due to the high body temperature and increased oxidation, like the rigor of exhausted muscle. In slower cases, fatty infiltration of the liver appeared and sometimes central necrosis of the lobules. It is evidently a protoplasmic poison. Changes in the blood are hard to explain. At first it is brownish red, then on exposure to air it changes to bright red. Lehmann and Schmidt were able to demonstrate methemoglobin by spectroscope but Koelsch never could, nor does he agree with them that there is a direct effect on the central nervous system, or on the respiratory center.

Koelsch concludes that dinitrophenol 1-2-4 is not so toxic as the nitrobenzols but must be regarded as dangerous and as calling for precautions in its handling, so that workers are protected from direct contact with it and from inhaling dust and fumes.—A. H.

BRASSFOUNDERS' FEVER. *F. H. deBalsac, E. Agasse-Lafont, and A. Feil. Abstr. as follows from Presse méd., July 10, 1926, no. 55, p. 866, in Office internat. d'hyg. pub., Bull. mensuel, Oct., 1926, vol. 18, p. 1200.*

After having studied actual conditions of work in the brass foundry, the authors contribute some new observations concerning founder's fever. They described the attack of the fever thus: A man is at his work as usual, without being more fatigued than on other days; he is not suffering any discomfort. But immediately after he leaves the factory, or during the next hour, he is conscious of stiffness and a feeling of exhaustion, his legs give way under him, he is seized with an attack of trembling in his extremities, he shivers, sometimes he complains of his head, and he is nauseated and dyspneic. Having no appetite, he retires without eating. He continues to shiver in bed; his temperature fluctuates around 38°C.; he does

not sleep. Then during the night, generally at the end of some three or four hours, profuse sweating occurs; this is the end of the attack and the man goes to sleep. The next day he awakens, occasionally somewhat stiff but generally feeling well and ready to return to work. Other symptoms among these workers are cough, sweet taste in the mouth, sometimes hemorrhage of the anus, headache, sweating, and a tendency to mononucleosis. A single attack is not dangerous but a repetition is not without troublesome effects on the organism, such as difficult digestion, increasing fatigue, and emaciation, producing finally a true cachexia.

In explanation of this fever and its symptoms among brassfounders, the authors cite the noxious effect of zinc and the excessive heat at the furnaces. Founders' fever appears to be more frequent in winter. The attacks take place especially in cloudy weather—undoubtedly because the fumes of zinc oxide are then more difficult to remove.

In order to lessen the danger of poisoning from zinc fumes and the risk of founders' fever which appears to be directly connected with them, the following measures should be considered:

1. Inasmuch as many foundrymen work from 6 A.M. to 1 P.M. and are forced to eat at the plant, a wash-stand and well-aired quarters with tables where the men can eat should be provided.

2. In order to allow the worker to devote enough time to his meal a supplementary foundryman should be put in charge of the furnaces for that time.

3. The workers should be examined every two or three months so that those most susceptible to the fever may be directed to another occupation.

4. Some foundrymen take milk at the factory and find it beneficial—this practice should be made general.—B. A.

DUST HAZARDS AND THEIR EFFECTS

REPORT OF THE MINER'S PHTHISIS MEDICAL BUREAU FOR THE TWO YEARS ENDED JULY 31ST, 1926. *Union of South Africa, 1927.*

Apart from details concerned with work done and a description of modified procedure necessitated by an Act passed in 1925, this report contains much of direct scientific interest relating to the nature and progress of "miners' phthisis," under which term silicosis and its sequelae are grouped. By combining information for two years in one report, Dr. L. G. Irvine, the new chairman of the Medical Bureau, brings matters reasonably up to date. He points out that continued experience is refining the skill and perception of the medical experts and that the technical quality of radiography has been greatly improving; hence early cases are now being detected which were formerly missed. At the same time, owing to improved health conditions, the age distribution of the mining personnel is becoming more favorable; thus whereas in 1917 to 1918 miners of 30 years of age and over formed 59.4 per cent. of the European personnel, in 1925 to 1926

the percentage had risen to 74.4. Hence the proportion of miners having long exposure to silica dust has been increasing and with it an inevitable increase in the number of those liable to develop silicosis has taken place. These two influences, improved skill and altered age distribution, are held to account for a pronounced increase in the annual production rate of silicosis.

Although more cases are thus coming under observation, the type of case has been changing; as it takes longer to develop, the old type is disappearing, characterized by extensive fibroid consolidation, with large, heavy lungs, wherein the dust factor was predominant over the infective factor. Now the infective factor is predominant and the dust factor takes second place. The opinion is expressed that both factors act together in originating lesions, both being carried into the lungs by the same type of cell; then the fibrosis may localize the tuberculous infection. Subsequently, usually by inhalation, a new or further infection occurs to activate the process; but, apart from this, there is a tendency for silicosis naturally to progress toward becoming overt tuberculosis. The survival rates for groups which, when detected, were simple silicosis, simple tuberculosis, or silicosis plus tuberculosis, point this way. At first the rate is far best for simple silicosis; but by the end of eight years it is only 9 per cent. better than for simple tuberculosis of which only 50 per cent. are alive. The survival rate for silicosis plus tuberculosis is extremely unfavorable, only 11 per cent. being alive after eight years.

The increasingly important part recognized to be taken by tuberculous infection has led to far closer medical supervision of mining natives. These natives easily contract tuberculosis; and lung lesions with them form only part of a generalized infection which runs a rapid and febrile course. The supervision is made a duty of mine medical officers, directed by the Medical Bureau; the Bureau itself examines and supervises European miners. The natives, 180,000 in number, are weighed every six weeks, when anyone losing 5 pounds or over since the last weighing is reserved for careful medical examination. Few natives remain at work long enough to contract silicosis; but any who remain five years or over are radiographed annually. Over 1,000 cases of active tuberculosis among natives were detected for 1925 to 1926, which, although representing an incidence of only 5.5 per thousand, amounts to a large infecting source. Undoubtedly the problem on the Rand has now largely been reduced to keeping the tuberculous from entering the mines and to combing out any that develop while employed. The problem indeed is closely similar to that of tuberculosis in any community—the exclusion of the infective carrier.

The report contains a wealth of statistical material bearing on the working of the compensation scheme, which is fully as intricate as the disease it compensates. This information, which is massive, is too condensed for summary.—E. L. C.

REPORT ON AN INVESTIGATION OF THE PULMONARY CONDITIONS OF MINE EMPLOYEES, WESTERN AUSTRALIA, DURING THE YEARS 1925–1926. *W.*

T. Nelson. Commonwealth of Australia, Dept. Health, Ser. Pub. (Div. Indust. Hyg.) No. 5, 1927, pp. 99.

The author summarizes his study as follows:

In the course of this investigation, 4,067 men were examined, 3,039 at Kalgoorlie and 1,028 at nine other mining centres throughout the State. A mobile laboratory with a portable X-ray plant was despatched from Kalgoorlie to these other centres. The men examined were working mine employees with the exception of 48 ex-miners. A complete medical examination was made, an X-ray picture of the chest being an important feature of the examination. An industrial history was also taken. In a number of examinees certain special physical measurements were recorded.

The results of the investigation show that of the 4,067 men examined, 798, or 19.6 per cent., presented definite evidence of pulmonary silicosis, and 155, or 3.8 per cent., of tuberculosis, twelve of the latter having tuberculosis without silicosis.

Surface workers numbered 1,759; 6.6 per cent. had silicosis, 1.5 per cent. silicosis plus tuberculosis, and 0.3 per cent. tuberculosis without silicosis. Of surface workers without previous underground experience those engaged in dry milling showed the highest incidence of silicosis—9.6 per cent. being affected contrasted with 2.2 per cent. in the case of persons engaged in wet milling without any dry mill experience, and 2.0 per cent. of others who had no wet or dry milling experience.

Underground workers numbered 2,308, of whom 23.3 per cent. had silicosis, 5 per cent. silicosis plus tuberculosis, and 0.3 per cent. tuberculosis without silicosis. No fewer than 51.5 per cent. of persons engaged in developing, and 39.2 per cent. in stoping, were affected with silicosis or tuberculosis contrasted with 8.4 per cent. in persons without stoping or developing experience.

The predominating influence of underground work in causing silicosis is shown by taking that group of men who had worked 21 to 30 years in the industry. Of those who had done no underground work during this time, 7.2 per cent. were found to be suffering from silicosis. In that group of men giving a history of having done 0–5 years underground work during this time, 13 per cent., 6 to 10 years underground work 21 per cent., 16 to 20 years underground work 44 per cent., and 26 to 30 years underground work, 68 per cent. were affected. It is evident, therefore, that stoping and developing are occupations in the mining industry most prone to cause silicosis.

It has been shown that the incidence of pulmonary disease among the miners is not due to previous work in countries other than Western Australia, but it appears, however, to be a fact that those men who have worked in mines outside Australia are affected to a greater extent than those who have worked in this State only.

Four royal commissions since 1905 have drawn attention to the dust hazard of these mines, and accurately anticipated the health conditions portrayed in this report. The unsatisfactory conditions of the hygiene of the mines as revealed by the royal commissions is reflected in the number of cases reported to be suffering from pulmonary silicosis. Examination of the dust content of mine air further confirms this. Of 1,595 samples of air taken underground, 35 per cent. had dust counts exceeding the arbitrary safe limit of 300 particles of dust per c.cm. It was further found that, at the time of these examinations of mine employees, 62 per cent. of the rock drills in use on the seven big mines of the Golden Mile were of the axial water-feed type, but of these only 18 per cent. were in use prior to August, 1924. Blasting is carried out in the ordinary course of the shift except in the case of one or two mines, in which an attempt is made to confine it to crib-time or to the end of the shift. Analyses of samples of the ore deposits in various mines of the Golden Mile show that the quartz content varies from 21 to 33.5 per cent.

In the final diagnoses the elucidation of the pathology of many cases of "complicated silicosis" was found to be very difficult. The problem is intimately bound up with "latent tuberculosis" in silicosis. Silicosis is found to be a condition of generalized fibrosis of the lungs giving a characteristic appearance to the X-ray pictures of lungs so affected. High blood-pressure is

more common among silicotics than among normal workers, and albuminuria also is more common. Silicosis has no appreciable effect on the body-weight. Generally speaking, silicosis causes a reduction in the vital capacity of an individual so affected, and it is found that in this condition there is a general diminution of the respiratory excursion of the chest in all its diameters. Expiratory and inspiratory forces are found to be unimpaired, there being no inhibition of the force of respiration interfering with the vital capacity readings.

This was purely a clinical inquiry, there being no opportunity for post-mortem investigations. Neither was it possible to admit doubtful cases into hospital for close observation.

—C. K. D.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

PROFESSIONAL DERMATOSIS. *R. Casazza. Abstr. as follows from Gior. ital. di dermat. e sifil., May, 1927, vol. 68, p. 671, in Arch. Dermat. and Syph., Dec., 1927, vol. 16, p. 765.*

Calcium cyanamide ($CaCN_2$) is a fine, bluish-black powder used in agriculture in Italy. It produces toxic phenomena like tachycardia, dyspnea, congestion of the face, and collapse. On the skin, it produces erythema, urticaria, eczematoid and bullous dermatitis and multiple and extensive sphaceloderma. Two cases of the latter are reported.

MELANODERMA TOXICA LICHENOIDES ET BULLOSA (HOFFMANN). *E. Freund. Abstr. as follows from Gior. ital. di dermat. e sifil., June, 1927, vol. 68, p. 998, in Arch. Dermat. and Syph., March, 1928, vol. 17, pp. 409–410.*

This is the second case of this rare condition reported by the author. The patient was an Italian worker who had been exposed to fumes of melting tar for several months. The face, neck, abdomen, and forearms were the seat of a slate-brown pigmentation of reticular arrangement and lichenoid appearance. Several spots were present in the conjunctiva. Histologically, hyperkeratosis, perivascular infiltration with numerous chromatophorous cells and free pigment granules were present.

The author believes that the condition is produced by the action of the fumes of tar on the skin. His first case, reported in 1926, had the same etiology.

INJURIES TO THE HAND AND FINGERS BY ANILINE PENCILS. *M. Iselin. Presse méd., 1927, vol. 35, pp. 467–469.*

The author summarizes information published since 1920 relating to the occurrence of necrosis in the hand, set up by fragments of aniline from pencils. A case of his own induced him to undertake this review. Apparently this material, when it gets under the skin, not only stains the surrounding tissues but causes their death. There eventuates an aseptic chemical necrosis with but little inflammatory reaction. All the tissues stained sooner or later are affected, and the process tends to go deeper and may finally cause necrosis of the bones. If left alone, a fistula may occur with a chronic, colored discharge. Treatment should include removal of all stained parts; if left untreated, amputation of the part affected may be necessary. Erdheim of Vienna car-

ried out certain experiments on mice and found that methyl violet exerted a powerful local necrotic action; but that methylene blue stained the tissues generally through the body and set up a sort of true septicemia. He found that other coloring substances were also able to produce necrosis. The author reports that in his own case he obtained unexpectedly good results by using ultraviolet rays. The whole subject reported is one of considerable interest, even though no cases have yet been noted in English literature.—E. L. C.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

THE INFLAMMABILITY OF MINE-GAS MIXTURES. *H. F. Coward and R. V. Wheeler. Abstr. as follows from Brennstoff u. Wärmewirtsch., 1927, vol. 9, pp. 431–434; Colliery Guardian, no. 3370, in Chem. Abstr., Jan. 20, 1928, vol. 22, pp. 318–319.*

The ignition temperature of mine gas decreased, with increasing duration of heating, from 735° for 0.5 second to 646° for 15 seconds, and, with increasing pressure, about 100° from 0.5 to 7 atmospheres. Tables of experimental data on the ignition of methane-air mixtures in various proportions, by various means, are given. The delay in ignition (*i.e.*, duration of exposure to exciting cause required) is characteristic of methane. It increases with the percentage of methane and decreases with increasing temperature. Ignition by adiabatic compression (without flame) might result from blasting operations. The necessary compression ratio and calculated corresponding temperature pass through minima at about 7 per cent. methane by volume. The explosive limits are extended by compression. Danger of explosion from heated surfaces, which may involve contact catalysis, is less than from flames and depends on the area and temperature of the surface and the duration of contact. Larger surfaces are more dangerous than hot wires at the same temperature, and the latter more than friction sparks. The danger from electric sparks depends on their intensity. Direct current and alternating current are alike in this respect. Eight and one-half per cent. methane requires the lowest intensity. The mixture of greatest flame propagation velocity is not the same as that of lowest ignition temperature (*e.g.*, 10 per cent. and 6 per cent. methane, respectively).

EFFECTIVE ROCK-DUSTING OF COAL MINES. *G. S. Rice. U. S. Bur. Mines, Information Circ. No. 6039, June, 1927, pp. 7 (mimeographed).*

This circular presents concisely the requirements for effective rock dusting of coal mines in order to prevent propagation of mine explosions, and points out the principal related facts on explosibility of coal dusts and mixed coal mine dusts.

In conclusion, the author states that "the only safe procedure in the preventing of disastrous explosions is to rock dust thoroughly in every accessible part of a mine. Re-rock-dust immediately when the content of either floor dust or rib and timber dust

falls to 55 per cent in any zone in the mine and maintain at all times the average noncombustible content of the mine dust above 65 per cent."—M. C. S.

COAL-MINE FATALITIES IN THE UNITED STATES: 1926. *W. W. Adams. U. S. Bur. Mines, Bull. 283, 1927, pp. 121.*

The number of deaths caused by accidents in the coal mines of the United States in 1926 was smaller in proportion to the amount of coal produced than ever before recorded except in the three years 1923, 1920, and 1916. Bituminous coal showed a slightly higher loss of life per million tons than in 1925, but there was a substantial reduction in the death rate for anthracite mines, making the death rate for all classes of coal mines 3.79 per million tons as compared with 3.84 for 1925 and an average of 3.96 for the five years 1921 to 1925.

Analysis of fatalities according to cause showed that falls of roof and coal were responsible for 48 per cent. of the total, haulage accidents underground for approximately 17 per cent., explosions of gas or coal dust for 16.8 per cent., and accidents directly due to electricity for 3.78 per cent.

Numerous statistical tables accompany the report.—M. C. S.

DRILLING AND BLASTING IN OPEN-CUT COPPER MINES. *E. D. Gardner. U. S. Bur. Mines, Bull. 273, 1927, pp. 98.*

This Bulletin is devoted chiefly to a description of methods. There are, however, two sections of possible interest to readers of THIS JOURNAL—Practices Affecting Safety, and Accidents Due to Explosives.—M. C. S.

ACCIDENTS IN THE "DAGESTANSKIJE OGNI" GLASSWORKS. *A. Flerovsky. Gigiena Truda, 1927, no. 5, pp. 82–85.*

In this glassworks, where glass is manufactured by the Fourcault system, mechanization of the plant had not yet been completed (at the time of this investigation), so that the glass was still transported by the workers, and a large number of accidents were thus caused. This factory was put into operation in the summer of 1926; the number of accidents increased every month, there being in August fifty-nine accidents resulting in loss of working capacity; 64.4 per cent. of all accidents were due to cuts. In September, 1926, transportation of the glass was mechanized and the number of accidents quickly fell off, sinking to 15—a decrease of from 20 to 5 per cent. in accidents for the year—and the number of cuts decreased from 23 to 6 per cent. In October of the same year the workers received new work clothes to take the place of the old worn-out ones; accidents decreased to 0.7 per cent., the cuts to zero.—B. A.

DANGER OF IGNITION OF INFLAMMABLE LIQUIDS BY STATIC ELECTRICITY. *D. Holde. Abstr. as follows from Farben-Ztg., 1927, vol. 32, pp. 2422–2424, in Chem. Abstr., March 10, 1928, vol. 22, p. 869.*

Holde illustrated by several experiments the danger of ignition caused by static electricity when an inflammable liquid of a low electrical conductivity such as benzene, benzine, etc., is poured from an ungrounded metallic container.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

THE INFLUENCE OF PHYSICAL TRAINING ON THE BASAL RESPIRATORY EXCHANGE, PULSE RATE, AND ARTERIAL BLOOD PRESSURE. *A. C. Schneider, R. W. Clarke, and G. C. Ring. Abstr. as follows from Am. Jour. Physiol., 1927, vol. 81, pp. 255–263, in Physiol. Abstr., Feb., 1928, vol. 12, pp. 639–640.*

The basal metabolism declined during training in three subjects, and was unchanged in two subjects. It returned to normal after training. The basal minute-volume and respiratory rate were unaffected by training. It slowed the basal and early morning standing posture pulse rates, but had no effect on the early morning arterial blood pressure.

PHYSIOLOGIC MODIFICATIONS IN HUMAN ORGANISM DURING FLIGHT. *F. F. Lelli. Abstr. as follows from Arch. di antropol. crim., Sept.-Oct., 1927, vol. 47, p. 762, in Jour. Am. Med. Assn., April 7, 1928, vol. 90, pp. 1166–1167.*

No changes in respiration are noted at a height of from 1,000 to 2,000 meters. At from 2,000 to 5,000 meters respiration becomes more rapid and the aviator may experience air hunger. At this height, both acidosis and alkalosis of the blood have been noted. The Italian school has demonstrated acidosis by establishing a loss of alkalinity on the part of the kidneys. Acceleration of the pulse at a high altitude may result from lowering of barometric pressure or from emotion. A sense of painful constriction in the cardiac region, with tachycardia and congestion of the face, is sometimes noted in rapid descent. The blood pressure increases in ascent and decreases in descent. According to some observers, arterial hypotension is the result of the excitation of the labyrinth, with reflex vasodilatation. Anorexia, nausea and vomiting, a state resembling seasickness, as well as dryness of the mouth, are experienced by some. Hemorrhages do not occur at these altitudes. Mild auditory and visual disturbances occur frequently. Concentration, judgment, and decision diminish strikingly at altitudes of 7,000 meters and higher. Some of these effects are not unlike those caused by alcohol. Among the consequences noted after a flight are: fibrillary tremors of the extremities, rapid pulse, a sense of fulness in the ears, severe headache, which may persist for forty-eight hours, urinary suppression, nervousness, restlessness, and insomnia.—K. R. D.

RELATIONSHIP OF STATIC AND DYNAMIC DATA TO CONSTITUTIONAL VIGOR IN SELECTION OF AIR PILOTS. *G. Sgarbi. Abstr. as follows from Arch. di antropol. crim., Sept.–Oct., 1927, vol. 47, p. 792, in Jour. Am. Med. Assn., April 7, 1928, vol. 90, p. 1167.*

The author considers the determination of the dynamic qualities of the cardiovascular system, as practised in the United States, an insufficient criterion, because, in his opinion, the pulmonary apparatus is of greater importance to the aviator than is the cardiovascular. He proposes a new index—a thoracopulmonary index, ob-

tained from six measurements: (1) the index of the thoracic cavity obtained by multiplying together the anteroposterior, transverse, and sternal diameters; (2) the vital capacity, estimated by Verdin's apparatus on the basis of ten respirations; (3) the respiratory force, determined with Pech's mask; (4) the same obtained with nasal respiration only; (5) the tonicity of the diaphragm and of the respiratory muscles, obtained with forced voluntary apnea following a single prolonged inspiration.—K. R. D.

SUITABILITY TESTS FOR WORK IN MINE RESCUE WORK. *Hörnicke and Bruns. Abstr. as follows from Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 298–304, in Bull. Hyg., March, 1928, vol. 3, p. 226.*

The article deals mainly with tests to determine the most suitable physical qualities of persons to be trained for mine rescue work, *i.e.*, age, chest development, etc. Reference is made to the physical requirements laid down in Great Britain and also to those laid down in Soviet Russia in 1922.

Eleven men were subjected to endurance tests with various forms—old and new—of German self-contained oxygen breathing apparatus—Dräger, Inhabad, and Audos—supplying 2 liters of oxygen per minute.

The following are the conclusions drawn: A powerful, well-built, well-trained rescuer did well with all the types of apparatus, while one of moderate strength might easily break down under the same work. The principal physical conditions are good respiratory and circulatory organs. Training in the breathing technic is very important. Slow, deep breathing, good chest expansion, good diaphragmatic movement, large chest capacity, quiet, strong heart action, without high pressure, are guarantees of the ability of a man for rescue work.

If to these qualities are united the necessary coolness, confidence, experience, and energy, risk of failure is further diminished.

In testing various kinds of apparatus it is best to select men of moderate powers because, if the physically and psychically strong are chosen, the weaknesses in the construction of the apparatus may be masked.

The old types tried naturally induced the highest rate of breathing frequency and the highest pulse rate. Masks are much safer than mouthpieces.

α-LOBELINE. *M. J. King, H. R. Hosmer, and M. Dresbach. Abstr. from Am. Jour. Physiol., 1927, vol. 81, p. 491, in Physiol. Abstr., Feb., 1928, vol. 12, p. 649.*

Amounts of from 0.08 to 0.12 mg. per kilo in lightly narcotized animals caused short but marked respiratory activity. The effect was absent in deep anesthesia. It affects the blood pressure and blood sugar similarly to adrenaline; 0.21 mg. per kilo in normal unanesthetized man intravenously caused dyspnea, weak pulse, and pain in the cardiac region.

ECONOMY OF HUMAN MUSCULAR WORK. I. SIGNIFICANCE OF AGE. *H. Gessler and R. Markert. Ztschr. f. Biol., 1927, vol. 86, pp. 173–180.*

THE PHYSIOLOGICAL COST OF THE MUSCULAR MOVEMENTS INVOLVED IN BARROW WORK. *G. P. Crowden. Indust. Fatigue Res. Board, Rep. No. 50, pp. 19. H. M. Stationery Office, 1928.*

The wheelbarrow is one of the earliest of labor saving devices, but a study of the best way to use it forms the most recent publication of the Industrial Fatigue Research Board. The use of barrows for transport in the manufacture of bricks was closely investigated by ascertaining variations in the physiologic cost of muscular movement, as measured by oxygen consumption, when barrows of different heights were loaded in different ways. The normal load was seventy finished bricks, weighing about 400 pounds. The optimum arrangement of a load is one which almost balances the weight on the axle of the wheel, when the hand grips are raised to the height of the worker's hands as he stands erect with his arms hanging vertically; in this position the vertical tension should be about 15 pounds. Clearly, for men of varying height, the arrangement of loads must be varied; diagrams are given indicating the best load arrangement for varying heights, they differ from a base of five bricks with columns six bricks high for a balance height of $30\frac{1}{4}$ inches to a base of seven bricks with columns five bricks high for a balance height of 36 inches. A normal brisk walking pace was found less costly than either a slow walk or a fast rate. Compared with the cost of traveling 50 yards along the flat, one stoppage involved 30 per cent. increase in the oxygen cost of the work. The total cost over a distance of 50 yards is made up as follows: (1) gravity factor, raising and lowering handles, 114 c.c. oxygen cost, or 7.75 per cent.; (2) acceleration factor, attaining speed and stopping, 317 c.c. oxygen cost, or 21.55 per cent.; and (3) velocity factor, maintaining speed for 50 yards, 1,040 c.c. oxygen cost, or 70.7 per cent., giving a total of 1,471 c.c. oxygen cost, or 100 per cent. Adequate control and balance of a barrow with minimum tension on the arms is a matter of practice which only a skilled barrow worker attains.

Investigations made to ascertain the optimum load for a barrow, apart from the method of loading, disclosed that seventy bricks was the optimum load for the type of barrow used, and that loads greater or less than seventy involved increased oxygen consumption on the part of the worker; this load was found to be the practice in the trade. Some economy of effort was obtained by lengthening the legs of the barrow and so lessening the lift necessary to attain the balance height. The legs, however, must have good clearance from the ground to permit of free wheeling; a length of 18 inches was found best and has been adopted. An appendix indicates how the observations made are being applied to works practice. The report is well and clearly illustrated throughout.—E. L. C.

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WOMEN AND CHILDREN IN INDUSTRY

THE PERIOD OF REST FOR LYING-IN WOMEN. *Foreign Letter (Paris), Jour. Am. Med. Assn., March 24, 1928, vol. 90, p. 994.*

A decree published in the *Journal officiel* modifies Article 29 of the Code of Labor, which accords to a worker or employee twelve consecutive weeks of rest following her confinement.

The new decree stipulates that the birth or prospective birth of a child cannot be utilized by the employer as a pretext for breaking a wage contract and for dismissal of the worker, provided she has given the employer sufficient notice. The period of rest may be extended to fifteen weeks in case of difficult labor or in the event of complications arising. The dismissal of the worker by the employer during the allowed period of recuperation constitutes a cause of action against the employer for damages, for which suit the worker will not be required to pay costs. Any clause written into the wage contract in contravention of this stipulation is declared in advance null and void. —K. R. D.

THE EFFECT OF AGE, OCCUPATION, THE NUMBER OF PREGNANCIES, AND GENERAL LIVING CONDITIONS OF THE MOTHER ON THE WEIGHT OF THE FETUS. *N. Pismenny. Gigiena Truda, 1927, no. 4, pp. 41–51.*

From data at his disposal concerning the weight of the new born in the obstetric department of an important textile factory, which were systematically recorded for a number of years, the author attempts to deal further with this question. The sick and immigrants were not considered. All statistics were divided into three periods: the prewar period (1905 to 1914), the war period (1915 to 1917), and the Soviet period (1918 to 1926).

With factory workers the weight of the fetus was less in the Soviet period than in the prewar period; this must be regarded as a result of the hunger period. With spinners the weight of the fetus increased—a fact which may well be explained by the leave of absence before delivery introduced by Soviet legislation.

Occupations may be graded as follows according to their diminishingly injurious effects on the development of the fetus: spinners, dyers, weavers, unskilled workers, and farmers' wives. The more injurious is the occupation, the sooner the child bearing period ends; with the groups mentioned, the percentage of women aged 40 bearing children is correspondingly 2.79, 3.73, 4.15, 4.76, 5.92, and 7.— B. A.

SHORT TALKS ABOUT WORKING WOMEN. *U. S. Dept. Labor, Women's Bur., Bull. No. 59, 1927, pp. 24.*

Readers interested in standards for the employment of women, hours of work, and working conditions are referred to the sections of this publication summarizing the present situation with regard to these questions.

THE EFFECT OF LABOR LAWS FOR WOMEN. *M. N. Winslow. Personnel Jour., Dec., 1927, vol. 6, pp. 242–250.*

Miss Winslow describes the method of research adopted by the Women's Bureau of the United States Depart-

ment of Labor in its investigation to study in what way and to what extent labor legislation applying to women only has affected their employment in industry. The difficulties of this type of research are presented, necessitating a change in procedure from that based on statistical data supplemented by the interview to that based on the interview supplemented by statistical data.

During the nine months March to December, 1926, field work was carried on, securing schedules for more than 1,500 establishments employing women and holding personal interviews with more than 1,000 working women who had experienced a change in the law or who were employed under conditions or in occupations prohibited for women in some other states.

Preliminary analysis of the data secured shows that legal restriction of women's hours of work, almost without exception, had not affected the position of women nor the opportunities open to them, differences in policy of employment being shown to be due to changing requirements of the industry or occupation or to prejudice on the part of the employer or to precedent; that prohibition of women's employment at night was generally so approved by employers that it would be enforced whether there was a law or not; that in some special occupations, semiprofessional in type, indiscriminate application of hour and night work legislation had acted as handicap to some women, such as street car conductors, printers and proof readers, and pharmacists, more so than in the general run of manufacturing industries; and that the prohibitory legislation found in one or two states acted as a needless restriction on women's employment in a number of occupations.—B. A.

OPPORTUNITIES AND CONDITIONS OF WORK FOR MINORS UNDER 18 IN THE GLASSWARE INDUSTRY. *Pa. Dept. Labor and Industry, Special Bull. No. 18, 1927, pp. 42.*

The glassware industry was selected for special study because of its importance in the state of Pennsylvania, the relatively large number of minors employed, and the trying conditions of work which have been considered an inevitable part of the processes of glass making. Although many of the problems relate exclusively to the glassware industry, others are pertinent to all industrial establishments.

Twenty representative plants were studied, eighteen of which manufactured glass from raw materials and two finished and decorated glass. No heavy glass industries were included in this study as they employ relatively few minors under 18 years of age. Of the eighteen glass manufacturing plants studied, seven manufactured bottles, seven tableware, three lighting ware, and one glass tubing. These eighteen plants employed nearly half the total number of wage earners in all glassware factories of the state in 1925. There were 703 minors under 18 in the twenty plants studied, constituting 16 per cent. of all employees. The field work for the study was done between May and July, 1926.

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less than forty-eight hours per week in day shifts; seven out of fourteen plants which had night shifts worked them forty and less than forty-four hours per week. No boys under 16 years of age were employed on night shifts and no girls. In the finishing departments over half of the plants had fifty and less than fifty-two hours of work per week; only one shift was worked. Strains and hazards of the work, such as come from heat, glare, and chemicals, were studied and the protection provided, especially from heat, indicates that improvement follows where special study of the work has been made. The chief lead hazard was from dust due to bad housekeeping. Cuts and burns were the most frequent type of accidents. In one plant the girls working at reheating furnaces were provided with masks of fine wire mesh to temper the heat striking against their faces. First aid equipment which was readily available was provided in all the plants studied; three had first aid rooms in charge of graduate nurses, one of these plants having in addition a part time physician. The problem of posture was investigated, as about 80 per cent. of the 703 minors included in this study were standing or walking constantly. In some cases conditions had been improved by providing proper seating and chairs high enough to give the same relative position to the work whether the worker sat or stood.

Investigation of sanitary and service facilities showed that much had yet to be accomplished along these lines.—B. A.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

REGULATIONS FOR SPRAY COATING. TENTATIVE DRAFT. *Pa. Dept. Labor and Industry, 1928, pp. 24.*

These regulations include specifications for booth construction, exhaust systems, electrical installations, and the use and maintenance of respirators, and conclude with recommendations for sanitation and health and for protection from fire.—M. G. P.

THE RELATION BETWEEN ILLUMINATION AND EFFICIENCY IN FINE PROCESSES, WITH SPECIAL REFERENCE TO THE LIGHTING OF PRINTING WORKS. *H. C. Weston. Abstr. from Illumin. Eng., 1927, vol. 20, pp. 221–226, in Bull. Hyg., April, 1928, vol. 3, pp. 291–292.*

Mr. Weston refers to Ives' work in the United States on illumination in letter sorting (see THIS JOUR., 1926, vol. 8, Abstr. Section, p. 123) showing that the full output was only reached (*a*) at 14 foot candles by those with visual defects; and (*b*) at 8 foot candles by the normal; and cites Ruffer's finding that, although maximal visual acuity may not be reached even at 300 foot candles, a marked diminution does not occur until illumination is lowered to near the 10-foot candle level.

He then deals with important practical outcomes of research by the Illumination Research Committee on illumination for typesetters (see THIS JOUR., 1927, vol. 9, Abstr. Section, p. 119).

THE IMPORTANCE OF SHADOWS IN INDUSTRIAL LIGHTING. *Abstr. as follows from Illumin. Eng., 1927, vol. 20, p. 350, in Bull. Hyg., April, 1928, vol. 3, p. 291.*

"That underproduction and discontent among workers may be due as much to harsh shadows as to dim illumination" this article essays to prove from the results of two-years' research in America. Those results may be thus summarized:

1. In textile mills the 5 foot-candle light from naked 75-watt lamps was converted into 21 foot-candle light from 300-watt lamps in "Glass-steel" diffusers, but output fell 3 per cent. owing to glare and heavy shadows.

2. Substitution of 100-watt, "bowl-enamelled" lamps giving 14 foot-candles without deep shadows resulted in a 3.8 per cent. increase of output.

3. Substitution of wholly indirect lighting from 200-watt lamps giving only 8 foot-candles, but practically eliminating all glare and shadows, gave 7.7 per cent. increase of output of better work—while employees, who had previously refused to work the looms concerned, now preferred them as causing fewer headaches and less spoilage.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

FACTORY AND WORKSHOP. WELFARE. THE BISCUIT FACTORIES WELFARE ORDER, 1927, DATED SEPTEMBER 21, 1927. *Statutory Rules and Orders, 1927, No. 872, pp. 2. H. M. Stationery Office, 1927. Abstr. as follows in Bull. Hyg., Feb., 1928, vol. 3, p. 167.*

This Welfare Order relates to the installation of lavatory accommodation with adequate hot water supply in biscuit factories. The occupier is required to arrange for a systematic inspection of the hands and forearms of those engaged in the processes, for the purpose of detecting early signs of dermatitis. The inspection is to be conducted by a "responsible person" once a week. Those susceptible to dermatitis, or showing a tendency to develop it, shall, if practicable, be transferred to other work where contact with sugar or a mixture of sugar and other ingredients will be avoided.

The occupier is required to affix the Official Cautionary Notice as to the prevention and cure of dermatitis in such a position that it may be easily read by the persons concerned; and to provide suitable accommodation for clothing put off during working hours, and adequate arrangements for drying the clothing if wet. He shall also arrange for first aid treatment of injuries. An adequate supply of wholesome drinking water must be provided for the workers at suitable points in the factory or workshop. Each drinking water supply must be clearly marked "Drinking Water." Where a supply is not laid on by pipe it must be kept, and renewed every day, in suitable vessels protected from possible contamination.

WORKMEN'S COMPENSATION. STATISTICS OF COMPENSATION AND OF PROCEEDINGS UNDER THE WORKMEN'S COMPENSATION ACTS AND THE EMPLOYERS' LIABILITY ACT, 1880, DURING THE YEAR 1926. *H. M. Stationery Office, 1928, pp. 31. Cmd. 3005.*

Year by year since 1908 small annual reports, of which this is one, have been issued, containing much

interesting and valuable information which is liable to escape notice. The year under review was one during which British industry was much interfered with by cessation of work on the coal fields for six months. This cessation also affected work in other industries. The way in which risk varies in different industries can be measured by noting the cost of compensation per person employed. It amounted to 70s. 3d. for a miner and fell as low as 8s. 8d. for a factory operative; a laborer in the docks cost 41s.; in shipping, 25s. 11d.; in constructional work, 25s. 9d.; in quarries, 25s. 1d.; and on railways, 11s.

A pronounced difference is recorded with regard to the duration of each case between accidents and disease; the percentage of terminated cases which lasted twenty-six weeks and over for disease was 25.2, but for accident only 2.6, on the other hand nearly 61 per cent. of accident claims terminated in less than four weeks, but only 33 per cent. of cases of diseases. The number of cases of miners' nystagmus continued from the previous year still increased, but the new cases were, as might be expected with only half the year of employment, only half what occurred in 1925. There is no clear evidence that preventive measures are yet definitely reducing the incidence of this complaint. Information is given concerning compensation for silicosis in the refractories industries, in which compensation was paid for 249 cases of disablement, of which 194 were continued from previous years. The provisions of the Silicosis Compensation Act have now been extended to the grinding of metals, information concerning which industry may be expected in subsequent reports.

Readers will find much valuable information in the concise tabular matter presented, which enables them to compare the occurrences of the year with those of previous years. Thus we find that cases of skin cancer increased from 66 to 109, and of dermatitis from 691 to 837. The figures for lead poisoning were 411 in 1925, and 346 in 1926.—E. L. C.

CANCER AND TRAUMA FROM STANDPOINT OF COMPENSATION. *J. Seifferi. Deutsch. Ztschr. f. Chir., Sept., 1927, vol. 205, p. 145.*

HERNIA IN RELATION TO COMPENSATION LAW. *R. P. Batchelor. Atlantic Med. Jour., Aug., 1927, vol. 30, p. 683.*

COMPENSATION IN INDUSTRIAL LEAD POISONING. *B. Chajes and C. Lewin. Med. Klin., Oct. 28, 1927, vol. 23, p. 1661.*

WORKMEN'S COMPENSATION LAW IN ITS RELATION TO THE PHYSICIAN. *J. A. Hamilton. N. Y. State Jour. Med., Nov., 1927, vol. 27, p. 1238.*

THE WORKMEN'S COMPENSATION PROBLEM IN NEW YORK STATE. *Nat. Indust. Conference Board, 1927, pp. 375.*

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

OCCUPATIONAL DISEASES OF FORGERS. *A. Ter-Gasarov. Gigiena Truda, 1927, no. 5, pp. 15–22.*

From an investigation of 136 forgers who worked in a large plant the author found that the following phenomena accompanied the occupation: (1) chronic injury of the mucous membrane of the conjunctiva, of the throat, of the larynx, the bronchi, and apparently also of the stomach and intestine; (2) loss of elasticity and development of emphysema of the lungs owing to the character of the work and the inhalation of soot; (3) severe injury to the cardiovascular system; (4) in several cases specific change in the morphologic character of the blood and particularly an increase in the number of lymphocytes.

The observations made in the plant did not permit drawing any conclusion whatever relative to the favorable effect of the work in the forge on the course of tuberculosis. Moreover, the asymmetry of the right and left halves of the bodies of forgers, described by several authors, was not confirmed.—B. A.

CONDITIONS OF WORK IN THE GLASS INDUSTRY. *G. Gutmann. Abstr. from*

Zentralbl. f. Gewerbehyg., July, 1927, N. S. vol. 4, pp. 237–242, in Bull. Hyg., March, 1928, vol. 3, p. 230.

This article begins by a reference to the scheduling of glassworkers' cataract as one of maladies to be notified by medical practitioners and as one for which compensation is given under the Order of Dec. 23, 1923, in Germany.

The article, however, deals almost exclusively with a detailed account of the various processes in the manufacture of (1) sheet glass, and (2) pressed glass, the exact duration in minutes of each operation, and the length of rest pauses.

The author's opinion is that the furnace attendant in sheet glass works has excessively long hours—24 to 28 hours consecutively—of which 10 to 12 represent physical effort followed by 16 hours' pause until the next charge. The sheet glass maker has not such long hours, but his work is very arduous—11 hours including 2 hours off for meals and rest. Normally, the glass maker consumes 1 to 2 liters of beer and 2 to 3 liters of other liquids during a working shift.

The attempt to introduce pneumatic machines to carry out the blowing unfortunately failed in the two factories where it was tried, in consequence apparently of reluctance on the part of the workmen to use them. This the author regards as a bad setback.

In the manufacture of pressed glass the work is much less heavy and an eight-hour day can be introduced without difficulty.

In the author's opinion, the improvements now possible in larger glasshouses, such as the use of plenum systems of ventilation playing directly on the workmen engaged near the glory hole, and locally applied exhaust ventilation in polishing, cutting, and where use of hydrofluoric acid is called for, make the work much more healthy now than it used to be.

DANGERS IN THE GLASS INDUSTRY AND THEIR PREVENTION. *Brinkmann. Abstr. as follows from Zentralbl. f. Gewerbehyg., Oct., 1927, N. S. vol. 4, pp. 358–363, in Bull. Hyg., March, 1928, vol. 3, pp. 230–231.*

This is an address given at a meeting of the German Association for Factory Hygiene in Breslau. In Schleswig alone 16,000 workers are employed in 200 glassworks. The Minister of Labor is endeavoring to introduce an eight-hour day for as much of the glass industry as is practicable, and inquiry with this end has recently been extensive by the Factory Department. Employers maintain that the state of the industry will not stand it and that the health of the workers is not seriously affected.

The author himself went through 5,000 cards giving information as to illness and these he summarizes in tabular form. They suggest that tuberculosis or silicosis is not present in any marked degree.

Some interesting figures are given of glassworkers' cataract and glasses to prevent it. In 18 glassworks 46 men had cataract. Of these 1 was 26 years of age; 1 was 38; 9 were from 40 to 49; 25 from 50 to 59; and 10 over 60 years. In 38 workers the cataract was in the left eye and in the remaining 8 in the right. Very few wore glasses. Spectacles made by Zeiss cut off the ultraviolet rays and ultra-red or heat waves. The great advantage they

have is that their bright blue-green color makes them very transparent while at the same time they are light and comfortable to wear. They are, however, costly at present—19 marks a pair.

The author states that the Osram Company have found a substitute in lime and magnesia for the red lead formerly used to the extent of 25 per cent. in the mixture for incandescent electric light bulbs.

The paper deals with all the principal processes, finding in plenum systems of ventilation the best solution where heat is in question and in locally applied exhaust where there is dust or fumes.

WORKING CONDITIONS IN THE SULPHUR MUD BATHS OF TIFLIS. *A. Chmaladse. Gigiena Truda, 1927, no. 5, pp. 62-65.*

The atmospheric conditions of the work are extremely unfavorable, in the separate departments the temperature of the air reaching from 28.8° to 32.8°C., relative humidity being from 80 to 100 per cent., effective temperature 27 to 32—1.3 to 2.5 dry kata and 5.7 to 12.6 wet kata. Although a corresponding examination of the outer air likewise showed unfavorable results characteristic of the summer in Tiflis, the situation in the workrooms was significantly worse and is to be ascribed simply and solely to the conditions of the work. The attendants at the mud and sulphur baths are likewise exposed to the influence of the hydrogen sulphide, the presence of which in the air has been established by lead paper. Under these conditions the attendants have to perform the heavy physical work of conveying the mud, covering the patients, etc. The doctors at the hospital assert that there is a high incidence of sickness among the attendants. An agreement was reached between the employees and the administrative staff relative to the arrangement of an effective ventilation system; furthermore the workers were granted a rest pause of ten minutes at the end of every hour of work and a vacation of two weeks every year.—B. A.

PERMANENCE OF MEN AND WOMEN OFFICE WORKERS. *M. A. Bills. Jour. Personnel Res., Feb., 1927, vol. 5, pp. 402–404.*

STABILITY OF OFFICE WORKERS AND AGE AT EMPLOYMENT. *M. A. Bills. Ibid., April, 1927, pp. 475–477.*

Records of the Life Department of the Aetna Life Insurance Company, Hartford, Conn., were studied for the four years 1920 to 1923, inclusive. During that time 635 men and women were hired.

In the first study it was found that almost equal percentages of the 216 men and of the 419 women hired were still with the firm up to the time of the report (25 per cent. of men and 26 per cent. of women). Of those who left the firm, the women exceeded the men in average length of service by about a fourth of a year.

Permanency of service as influenced by age at employment was found to be greatest (54 per cent.) among men over 25 years of age when hired, 27 per cent. among men between 19 and 25, and 17 per cent. among men under 19. Corresponding figures for women were 37, 19, and 29 per cent. Various

explanations are suggested to account for these findings.—B. A.

ABSENTEEISM IN INDUSTRY: A LIST OF REFERENCES. *U. S. Month. Labor Rev., July, 1927, vol. 25, pp. 190–197.*

LABOR PROTECTION, ACCIDENT PREVENTION, AND INDUSTRIAL HYGIENE IN SOVIET RUSSIA. *A. Dworetzky. München. med. Wchnschr., Dec. 9, 1927, vol. 74, pp. 2100–2103; Dec. 16, 1927, pp. 2147–2149.*

In the first instalment of this paper Dworetzky outlines the general legal provisions regarding length of working day, overtime, leave of absence, and protection of women and children, and shows how these provisions work out in actual practice.

The second part continues with a discussion of the legal requirements governing accident prevention—provision of protective clothing, gas masks, goggles, etc.—and industrial hygiene—periodic examinations, duties of inspectors and industrial physicians. A brief account of the aims and activities of the chief institutions engaged in research in the field of labor protection concludes the paper.—M. C. S.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

CENTRAL NERVOUS SYSTEM

DISSEMINATED SCLEROSIS: THE RAT AS A POSSIBLE CARRIER OF INFECTION. *I. G. H. Wilson. Abstr. as follows from Brit. Med. Jour., Dec. 31, 1927, vol. 2, pp. 1220–1222, in Jour. Am. Med. Assn., Feb. 18, 1928, vol. 90, p. 575.*

The occupations of 688 persons dying of disseminated sclerosis in 1925 have been investigated by Wilson, and seventy-two patients have been interviewed with regard to their exposure to rat infested water. The observations of other investigators as to heavy incidence in agricultural workers and woodworkers have been confirmed. The incidence appears to be heavy also among painters, plumbers, molders, and wool and cotton workers. Clinical histories show some evidence in favor of the possibility that the infection of disseminated sclerosis is spread by rats and water.—K. R. D.

BRAIN, SPINAL-CORD, AND NERVE INJURIES: WITH SPECIAL REFERENCE TO THEIR INDUSTRIAL ASPECTS. *C. E. Dowman. Proc. Fourteenth Ann. Meeting Internat. Assn. Indust. Accident Boards and Commissions, U. S. Bur. Labor Statistics, Bull. No. 456, Feb., 1928, pp. 94–101.*

SENSORY PARALYSES OF TRIGEMINAL NERVE IN INDUSTRY. *L. Kalinowsky. Ztschr. f. d. ges. Neurol. u. Psychiat., Sept. 1, 1927, vol. 110, p. 245.*

CIRCULATORY SYSTEM

THE BLOOD PICTURE IN WORKERS IN PLANTS WHERE HOT METAL WORK IS DONE, AND ITS SIGNIFICANCE. *E. Schubenko-Schubin and F. Gabusova-Schubenko. Gigiena Truda, 1927, no. 5, pp. 22–27.*

A complete morphologic examination was made of the blood of 155 workers (113 forgers and 42 casters).

The samples of blood were taken after work between 3 and 6 P.M. from a succession of men while still at their workplaces, at the end of different work periods.

The blood examination showed that (1) hemoglobin percentage and erythrocyte count were lower than normal, particularly in the casters, this phenomenon exhibiting not a sharp but rather a progressive rise with continuation of occupation; (2) the number of lymphocytes was significantly higher than normal, especially in the casters, and increased with continuation of work; and (3) the percentage of neutrophils, fluctuating within the limits of normal, diminished with continuation at work.

Blood analysis of the forgers and casters in the different work periods showed the following changes due to processes of the work: rise in hemoglobin, increased erythrocyte and leukocyte counts, diminished number of eosinophils, increased number of staff-like neutrophils, and sharply defined absolute and relative lymphocytosis.

The author can account for the constant relative hyperchromatism only by the retention in the workers' organism of the heat which is produced by the difficult working conditions of the forgers and casters; the changes in the blood picture present the physiologic reaction of heavy work done where it is too hot, or, in other words, the morphologic rôle of an acute and chronic fatigue.—B. A.

NEUROMUSCULAR SYSTEM

OLECRANON BURSITIS. *W. W. Lasher and L. M. Mathewson. Jour. Am. Med. Assn., March 31, 1928, vol. 90, pp. 1030–1031.*

Results of cases of olecranon bursitis (so-called "miners' elbow") treated both with and without prompt resection of the bursa lead the authors to conclude that the olecranon bursa is much larger and more extensive than is usually considered; that an acute infection of this structure demands an early operation with complete removal; that if an operation is not performed for the condition, an osteomyelitis of the underlying bone is a most frequent complication; and that patients seen early and operated on immediately make a rapid and complete recovery.—K. R. D.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

THE EMISSION OF GAS IN MINES. *E. O. Simcock. Abstr. as follows from Colliery Guardian, 1927, vol. 133, pp. 379–380, in Chem. Abstr., Jan. 20, 1928, vol. 22, p. 312.*

Pressure increase up to a maximum of about one-half inch of water was observed in a sealed-off area. Ninety-seven volumes of methane, 2 volumes of carbon dioxide, and 1 volume of nitrogen, and in two samples some higher hydrocarbons, were found in the emitted gas. A constant rate of emission of one-fiftieth inch per minute was calculated for an emitting area. Rate of emission exceeded rate of diffusion at a certain smaller area.

ATMOSPHERIC POLLUTION WITH ARSENICAL DUST. *G. Sowden. Abstr.*

as follows from Jour. State Med., 1927, vol. 35, pp. 668–670, in Bull. Hyg., April, 1928, vol. 3, pp. 286–287.

This article records the discovery of arsenic (as As_2O_3) up to 500 parts per million in dust from the flue, and 150 parts per million in dust from the rain water gutter, of a factory—the source being the ordinary coal used as fuel.

Arsenic to the extent of 0.01 grain (the amount which should not be exceeded by, *e.g.*, that in 1 pound of apples) is thus contained in 20 grains of such flue dust, which might easily be inhaled by a man sweeping such flues. As, however, the minimum lethal dose of 2 grains would only be ingested in ½ pound of such dust, a considerable amount of chronic arsenic poisoning might occur without a death to lead to detection of the cause.

COPPER IN MEDICINE AND IN INDUSTRIAL POISONING. II. PHYSIOLOGY AND TOXICITY OF COPPER AND ITS COMPOUNDS. *V. Mazzi. Rass. clin. terap. sci. affini, 1927, vol. 26, pp. 330–364, 416–440.*

LESIONS OF THE MOTOR PLATES IN LEAD POISONING. *J. M. de Villaverde. Abstr. as follows from Trav. du labor de recher. biol. de l'Univ. de Madrid, Dec., 1926, vol. 24, p. 267, in Arch. Neurol. and Psychiat., April, 1928, vol. 19, pp. 708–709.*

Daily doses of 1 c.c. of 1 in 100 and 1 in 500 solutions of lead acetate were injected under the skin of the back of rabbits, cats, and guinea-pigs. After a few days the animals began to grow thinner (particularly the cats) and showed symptoms of difficulty of locomotion, specially with the hind legs which tended to remain motionless. Some animals were killed before the onset of the symptoms, others were injected after severe symptoms had appeared.

Pieces of tongue, gastrocnemius, and soleus muscles were preserved in alcohol-ammonia, pyridine, and 10 per cent. of liquor formaldehydi. Cajal's reduced silver nitrate and Boeke's modification of Bielschowsky's method were used for staining. Other pieces of muscle were fixed according to the technic devised by Heidenhain for the study of diverse details of the muscle fibers. Muscles from normal animals were also used as controls.

When poisoning is not too severe the nerve fiber reaching the plate usually has a slightly varicose aspect. The same occurs in that portion of the fiber within the motor plate. There are fewer branches than in normal plates. This scarcity is due to degeneration of some of the branches; their remnants appear as short conical stumps which in some instances consist of condensed argentophil material, in others the latter appears fragmented in small blocks. Atrophy of the branches may be widespread and in such a case only the main stem, continuation of the nerve fiber, persists, and it appears beset with conical projections, remnants of the secondary branches.

The process of degeneration and atrophy of the thin branches of the motor plate differs widely from the phenomena observed during wallerian degeneration. The neurofibrillar network of the arborization begins to disappear and the individual neurofibrils are completely destroyed. The argentophil material appears in some cases as if it were condensed around

vacuoles, and it gives the impression of being agglutinated into fairly thick filaments. The branches show a double process of degeneration manifested in accumulation of the argentophil material in certain points, and its disappearance from others; as a result of these phenomena the neuroplasm appears occupied by scattered masses of argentophil material. Sometimes the masses are exceedingly small. The origin of the varicose swellings of the branches is difficult to explain.

Another fact that deserves mention is that atrophy of certain small branches of the plate takes place through separation of the argentophil material from the neuroplasm. Swelling and the characteristic granular arrangement seen in the first stages of wallerian degeneration were never observed in the plates of poisoned animals.

The network of Boeke appeared stained in some fibers. In some cases it showed a granular aspect, the beginning of its degeneration. Evidence of the continuity of the trabeculae of the network with the argentophil material is not noted, a fact already reported by Cajal.

In cases of severe poisoning (guinea-pigs injected for several days after the onset of poisoning symptoms) the disturbances caused by the injections are more profound. The muscle fibers lose their cross striations; only the longitudinal striations are visible. Boeke's network does not stain. In other respects the structure of the motor plate has not changed, but the nuclei are somewhat smaller than usual, and their outline is less sharp than in normal plates. The nerve fiber reaching the plate appears moderately varicose; the varicose swellings are small and their arrangement is such that the fiber shows a corkscrew-like appearance. In many plates the terminal arborization has been completely destroyed; others show remnants represented by deeply stained blocks of argentophil material not connected by neuroplasm as in cases of less severe poisoning. In many instances the plates still show some of the terminal branches. Separation of the argentophil material from the neuroplasm does not occur, nor vacuolization in those branches still present. The latter consist of deeply stained argentophil material with varicose aspect.

NITROGENOUS EXCHANGE IN EXPERIMENTAL LEAD POISONING. *M. Pavloff. Abstr. as follows from Compt. rend. Soc. de biol., 1927, vol. 97, pp. 361–362, in Physiol. Abstr., Feb., 1928, vol. 12, p. 652.*

There are two periods in intoxication: (1) corresponding to the introduction of lead into the organism, with reaction of increased nitrogen metabolism, catabolism exceeding anabolism; (2) later, a slowing of dynamic processes due to modification of oxidative processes, to the formation of intermediate products, and change of reaction toward acidosis.

ERGOGRAPHIC TESTS OF THE EXTENSOR MUSCULATURE OF THE HANDS OF LEAD WORKERS. *L. Schwarz and C. Albrecht. Abstr. as follows from Ztschr. f. Hyg., 1927, vol. 108, no. 1, in München. med. Wchnschr., Dec. 9, 1927, vol. 74, p. 2114.*

Tests made on seventy-three lead workers exposed to various lead haz-

ards and on twenty-seven non-lead workers showed no demonstrable preponderance of strength in the extensor group of the left hand as compared with the right extensors. The findings in lead workers gave practically the same results as those in non-lead workers.—M. C. S.

EXPERIMENTAL LEAD HEMATOPORPHYRIA. *H. Liebig. Abstr. as follows from Arch. f. exper. Path. u. Pharmakol., 1927, vol. 125, pp. 16–28, in Chem. Abstr., Feb. 20, 1928, vol. 22, p. 638.*

Rabbits which receive daily by mouth 0.1 gm. per kilogram of lead carbonate or daily intraperitoneal injections of 10 to 20 mg. of lead as lead glyconate invariably manifest an excretion of hematoporphyrin in the urine and feces. The intensity of the effect varies very greatly, the amount excreted not being proportional to the symptomatology of the poisoning. In lead poisoning no hematoporphyrin is excreted through the bile, and apparently the bone marrow is the site of its formation.

EXCRETION OF LEAD BY NORMAL PERSONS. *M. Marmeaux. Progrès méd., Nov. 19, 1927, vol. 54, p. 1831.*

ACCIDENTS IN THE MANUFACTURE OF BROMATE OF LEAD. *Witt. Abstr. as follows from Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 342–343, in Bull. Hyg., March, 1928, vol. 3, p. 236.*

Very little has been written about the explosive nature of this substance. In the *Zeitschrift für angewandte Chemie* (1925, pp. 929–930), it is shown that in its manufacture a complex lead acetate compound is present as an impurity, namely, diacetatodiplumbo bromate. This explodes violently on concussion or by friction.

The process of making the substance from lead acetate and potassium bromate is, therefore, condemned as there is no risk when it is made by the action of bromic acid on lead carbonate.

THE CURATIVE EFFECT OF THE MAZESTA SULPHUR BATHS ON LEAD POISONING. *K. Kasparov. Gigiena Truda, 1927, no. 5, pp. 67–70.*

During the cure season of 1925 to 1926 the author made observations with regard to the curative effect of the Mazesta sulphur baths (Caucasus) on forty-seven compositors, solderers, painters, etc., who were suffering from chronic lead poisoning. These baths have an unusually high content of sulphur and mineral matter. Each patient was prescribed twenty baths at a temperature of 27° to 29°C. lasting from six to ten minutes. The result of the treatment was that in twelve sick persons the symptoms of lead poisoning, such as colic, constipation, and cramps, completely disappeared; in twenty-eight cases these symptoms while not disappearing became significantly less severe and the working capacity of the men who were ill was restored; in seven cases the treatment was without results.—B. A.

THE EFFECT OF PICRIC ACID (MELINITE) ON THE ORGANISM. *J. Matussevitsch. Gigiena Truda, 1927, no. 5, pp. 44–48.*

In the Leningrad Institute for the

Study of Occupational Diseases twenty workers were examined who worked with picric acid. The author draws the conclusions that the yellow-green color of the skin, hair, and finger nails found in the majority of those examined is undoubtedly to be considered as the effect of the picric acid on the living tissue, and that the coloring in itself has no pathologic significance. The question of the eventual possible chronic absorption of the picric acid through the skin must first be cleared up by a very detailed experimental investigation. In all probability to the picric acid must likewise be ascribed the catarrh of the upper respiratory passages—the high percentage of these cases (85 per cent.) cannot be laid wholly to the effect of humidity and changing temperature. Picric acid apparently causes likewise an irritation of the mucous membrane of the stomach with subsequent changes of the tissue—a catarrhal condition of the gastric mucous membrane with severe diminution of the acidity of the gastric juice. Subjective complaints of those examined (a burning sensation in the nose and throat, headache, vertigo, general weakness, nausea, and vomiting) can be explained partly by the objective changes mentioned and partly by the general toxic effect of the picric acid which is as yet not fully understood.—B. A.

ON THE USE OF SODA IN FOUNDRIES. *M. Tscherniavskij. Gigiena Truda, 1927, no. 5, pp. 65–67.*

Workers in the foundry of a large concern manufacturing agricultural machines often came to the clinic complaining of headache, attacks of vertigo, ringing in the ears, nausea, etc. According to the statements of the workers, these conditions became worse as briquettes of soda and other compounds were added to the cast iron in order to reduce the waste arising from the high content of sulphur and gases in the raw material. In the desulphurizing process a gas is liberated consisting of sulphur dioxide, carbon monoxide, and oxygen. Examinations of the air made in the plant showed carbon monoxide present in the different workplaces in amounts of from 45 to 50 mg. per millimeter of air, in the middle of the room in amounts as high as 265 mg., when the soda crucible is carried in, and 700 to 900 mg. when chalk is poured into the crucible.

The industrial sanitary inspector has ordered the factory administration to install suitable ventilation apparatus in the places where the gases are liberated most.—B. A.

DUST HAZARDS AND THEIR EFFECTS

RESEARCHES ON PULMONARY ANTHRACOSIS. *A. Jousset. Abstr. as follows from Compt. rend. Acad. d. sc., 1927, vol. 185, pp. 730–732, in Bull. Hyg., March, 1928, vol. 3, p. 227.*

The author states that the attribution of the pigmented areas on the lungs of elderly people to the deposition of coal particles is pure fiction, and that pulmonary anthracosis, except in the special case of colliers, does not exist. He has analyzed colored and colorless areas of the lung with the following results as regards content of iron: black areas 0.7 mg. per hundred grams—colorless areas 0.068

mg. In the early stages of the pigmentation the pigment is contained in the dust cells which Jousset therefore terms "martial cells." The iron content of sputa varies similarly with the color from 10 mg. in colorless up to 110 mg. in almost black spots.

CIRRHOSIS OF LUNGS AFTER INHALATION OF DUST. *T. Matthies. Deutsch. med. Wchnschr., Oct. 28, 1927, vol. 53, pp. 1854–1856.*

A case of cirrhosis of the lungs is described in a woman who had sewed for ten years on "raw nettle tubing" (Rohnesselschläuche).

AN INTERESTING CASE OF OCCUPATIONAL ASTHMA. *Grimm. Zentralbl. f. Gewerbehyg., July, 1927, N. S. vol. 4, pp. 233–237.*

Grimm reports a case of asthma in a proprietor of a leather factory, who was exposed to the dust from oak bark used in tanning. He suggests as the cause of the irritation either the mites on the under side of the bark or the tannin in the bark itself. In support of the former, he cites from the literature several instances where mites have been responsible for asthma and eczema in workers.

Treatment consisted in attempts to desensitize the patient to the tanning dust. Upon returning to work, the patient was advised to grease his nostrils with vaseline and to insert loose cotton wool tampons in his nostrils before entering the dusty workrooms, and not to stay there any longer than necessary.—M. C. S.

INFLUENCE EXERTED ON THE HEALTH OF MINERS BY STONE DUST USED TO PREVENT EXPLOSIONS IN COAL MINES. *W. Gadzikiewicz and I. Jaranowska. Arch. Higjeny, Vilno, 1927, vol. 2, pp. 1–23 (French summary, pp. 23–24).*

This article is based on actual experimental work with animals. The authors conclude that stone dust, such as is used in the mines at Giesche, is by its chemical composition not dangerous to health; but excessive inhalation might set up pulmonary troubles such as occurred among experimental animals. Miners at work are not exposed to such conditions, and danger to their health from this cause is not great. Stone dust is introduced into the mines to prevent explosions and is less harmful to health than is watering used for this purpose; when dust is present in considerable amounts respirators can be worn by the miners, but care should be taken that the stone dust used does not become in any way infected with microbes. The suggestion is put forward that those in charge of the hygiene of mines should collaborate in research with clinicians and statisticians to ascertain what influence stone dust, when mixed with coal dust, has upon the respiratory organs.—E. L. C.

TOBACCO DUST AS AN INJURIOUS OCCUPATIONAL HAZARD. *A. Burstein. Gigiena Truda, 1927, no. 4, pp. 3–11.*

In this article the author draws the same conclusions that he gives in his article published in THIS JOURNAL (1927, vol. 9, p. 512).

A QUANTITATIVE METHOD OF DUST DETERMINATION. *A. Seitz. Abstr. as follows from Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, p. 328, in Bull. Hyg., March, 1928, vol. 3, p. 230.*

The author describes a photographic comparative method of estimating fine

dusts. It is intended to be serviceable only in the case of metallic dusts given off in the particular industry in question. The method consists in precipitating on a small celluloid plate exact weighed amounts of the metal dust. The plate is photographed and in this way standard dust scales are obtained. In lead industries, for instance, they would vary from 5 to 100 mg. of lead.

If in any industry it is desired to know the approximate amount of metal dust in the air a celluloid plate smeared with paraffin is exposed for some hours—preferably for twenty-four. If this is photographed, only the metal or mineral dust gives a sharp picture as the organic dust does not come out.

A Method for Studying the Condition of Air by Dust Determination. *A. Genny. Gigiena Truda, 1927, no. 4, pp. 35–36.*

After a series of experiments with various materials to obtain a filter for the quantitative determination of dust in air, the author chose a granular material, using glass beads 1½ to 2 mm. in diameter. The surface of the glass beads was moistened with castor oil. The author found that the glass beads, covered with oil, hold the dust particles entering the filter without mixing with them, making it possible to study the dust under the microscope and to put it through all chemical reactions after solution of the oil. These glass beads can also be used to study gases.—B.A.

Dust Collection in Industrial Plants, Particularly by Electroprecipitation. *J. Jelinek. Chem. Listy, 1927, vol. 21, pp. 323–333.*

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT, AND PREVENTION

Human Anthrax in Germany in 1925. *R. Spatz. Abstr. as follows from Reichs-Gsndhtsbl., 1926, Beiheft 17 to no. 52, pp. 409–413, in Bull. Hyg., March, 1928, vol. 3, p. 246.*

One hundred and seventy-three cases of human anthrax occurred in Germany in 1925, as against 135 in the previous year. Of these 160 were in males and 13 in females, 1 male and 2 females being under 14 years of age; 34 cases proved fatal (23 the previous year). Most of the cases were skin infections but 9 cases of internal anthrax were reported—5 alimentary, 3 lung, and 1 septicemic. The majority of cases occurred in connection with slaughterhouses (78) and tanneries (36) but a fair proportion resulted from the handling of dead animals or their products (22).

Anthrax Statistics in Germany in 1926. *R. Spatz. Abstr. as follows from Reichs-Gsndhtsbl., 1927, Beiheft 4 to no. 46, pp. 37–41, in Bull. Hyg., March, 1928, vol. 3, pp. 246–247.*

Dr. Spatz analyzes the cases of anthrax in Germany during 1926 in a manner similar to his previous paper. There were 105 cases, 90 in adult males and 15 in adult females of which 13 were fatal, as compared with 173 cases and 34 fatalities in the previous year. All the cases, except 3, were skin cases; 59 contracted the disease

from contact with diseased animals, 23 from contact with hides and skins, 9 from contact with hair and wool, while the remainder of the cases had an uncertain origin. The deaths in each of these classes were respectively, 5, 5, 1, and 2.

TREATMENT OF ANTHRAX IN MAN BY SERUM. *E. Bodin. Abstr. as follows from Presse méd., 1927, vol. 35, pp. 961–962, in Bull. Hyg., March, 1928, vol. 3, p. 247.*

The author states that anthrax in animals is becoming much less frequent in France owing to growing use by veterinary surgeons of preventive vaccination; but that human anthrax persists owing to the increasing use of imported foreign hides in tanneries. He advocates firstly the antiseptic treatment of all minor injuries and cuts in those exposed to infection and the immediate treatment of all suspected cases. Secondly, treatment is greatly more efficacious in the earliest stage before generalization has occurred. Since 1924 he has treated five cases with elevated temperature and other signs of intoxication by serum alone with the best results, using daily injections of 20 to 40 c.c. for several days, the total amounts given being from 50 to 190 c.c. without ill effects. The earlier the treatment, the better the results. Serum treatment should replace the older surgical methods of excision, injection of carbolic acid, etc.

RÔLE OF FINGER NAILS IN MECHANISM OF INFECTION WITH ANTHRAX. *H. Lindtrop. Arch. f. Dermat. u. Syph., Oct. 23, 1927, vol. 153, p. 793.*

AN ANALYSIS OF AN INFLUENZA EPIDEMIC IN THE NEW ZEALAND DIVISION OF THE ROYAL NAVY. *S. F. Dudley. Abstr. from Jour. Hyg., 1927, vol. 26, pp. 132–151, in Bull. Hyg., April, 1928, vol. 3, p. 356.*

The influenza epidemic occurred during the winter of 1926. Four out of five ships were attacked. The epidemic was a mild one. Although the number of cases was small the epidemic provided some interesting features and confirmed the following hypotheses which were suggested from previous studies by the author.

1. Influenza in more or less isolated areas such as islands or ships tends to assume special characters as regards infectivity, virulence, and clinical type. The isolation tends to encourage the evolution of new varieties and species of the influenza virus.

2. One wave of influenza, even if of a different type, will confer considerable immunity to a subsequent wave not only on those attacked but also on those who escaped during the first wave.

3. The brunt of the morbidity is borne by recruits and junior ratings because the senior men have acquired an immunity by autovaccination to the bacterial environment of crowded ships or barracks.

4. Senior ratings mixed with recruits suffer a higher morbidity from infectious diseases than they do under similar circumstances in the absence of recruits.

The problems which this influenza epidemic presented suggested that a method, as free as possible from personal bias, would be useful for the purpose of comparing the relative severity of symptoms in different groups of individuals taken together. The

procedure finally adopted consisted in averaging the temperatures for the same number of days of all the patients of a given sample and roughly estimating the relative amount of extra heat produced by this hypothetical average patient.

THE PHYSICIAN'S DANGER IN TREATING PATIENTS WHO HAVE SYPHILIS. *C. M. Whitney. Am. Jour. Syphilis, Jan., 1928, vol. 12, pp. 1–9.*

Ten cases of various types of digital chancre in physicians are described due to infection acquired in treatment of patients. None of these physicians were specialists in venereal diseases or treated any large number of such cases.—B. A.

EXPERIMENTAL ANTHRACOSIS AND TUBERCULOSIS. *A. Nohlen. Abstr. as follows from Ztschr. f. Kinderh., Dec. 16, 1927, vol. 45, p. 173, in Jour. Am. Med. Assn., March 17, 1928, vol. 90, p. 893.*

In animal experiments Nohlen found that soot injected intravenously is deposited almost exclusively in the lungs and there leads to typical anthracosis with formation of connective tissue and small cell infiltration. Histologic examination in moribund children (tuberculous meningitis, cavernous tuberculosis) receiving several soot injections of 1 c.c. showed a heavy deposit of soot and the formation of connective tissue with small cell infiltration around the tuberculous foci. The injections do not cause any disturbance of the general condition; they have a favorable effect on the course of the tuberculosis.—K. R. D.

PNEUMONOMYCOSIS PENICILLINA, LUNG TUMOR OF OCCUPATIONAL ORIGIN. *R. Nussbaum and T. Benedek. Beitr. z. Klin. d. Tuberk., Dec. 10, 1927, vol. 67, p. 736.*

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

OCCUPATIONAL AFFECTIONS OF THE FINGER NAILS OF WORKERS IN LEATHER FACTORIES. *G. Klebanov and V. Emdin. Gigiena Truda, 1927, no. 5, pp. 53–56.*

Among tanners the free edges of the finger nails are eaten away and scaled off, many small, painful excoriations are present on the skin at the lateral edge of the nail, and the finger joints show small ulcers.

The finger nails of the strippers are, without exception, injured on the sides along the free edge beginning with the third finger. In some cases the skin is exposed halfway down the nail and is covered with painful excoriations.

According to the authors' observations, these changes in the edges of the nails appear even during the first months at work, the intensity of the injuries depending in no measure on the length of time the worker is in this occupation. During leave of absence the injuries disappear. The nail injuries are explained as due to mechanical and chemical effect from grasping and selecting the wet leather skins and from contact with the tanners' liquor. Rubber gloves such as are used in many factories prevent the injuries of the finger nails and mechanization of the wet processes in leather factories will completely do away with such injuries.—B. A.

THE DERMATITIS OF BREAD BAKERS. *A. Starobinski. Rev. franç. de dermat. et de vénér., Dec., 1927, pp. 618–619.*

For three years, a bread baker and confectioner was troubled with clear vesicles, breaking out under the wrists and on the skin of the fingers. Cracks followed and the pain they caused, together with the intense itching, prevented the man from doing his work. The backs of the hands were red and desquamated freely. In the clear fluid from the vesicles the writer found mycelial filaments, indicating a variety of yeast.

Starobinski concludes that this case is similar to the one reported by Mummery (see THIS JOUR., 1926, vol. 8, Abstr. Section, p. 28). It is a pity the organism in both cases was not identified. The mycotic industrial skin diseases require further study.—R. P. W.

THE DISPOSITIONAL FACTOR IN INDUSTRIAL DERMATOSES. *A. Perutz. Abstr. as follows from Wien. klin. Wchnschr., 1927, no. 44, in München. med. Wchnschr., Dec. 2, 1927, vol. 74, p. 2075.*

Perutz discusses the effect of attention and fatigue on the frequency of traumatic injuries and the relation of idiosyncrasy to allergic skin diseases. —M. C. S.

INDUSTRIAL ECZEMA—DERMATITIS DUE TO HYPERSENSITIVENESS. *Rodenacker. Abstr. as follows from Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 325–328, in Bull. Hyg., March, 1928, vol. 3, p. 238.*

The author lays great stress on the part played by the psychic condition of the patient in the production of dermatitis and eczema. In this connection he thinks that the scheduling of dermatitis and eczema under workmen's compensation acts is bad in principle and is likely to hinder a cure by laying too much stress on the external agent and not enough on the hypersensitiveness of the skin. At the University Skin Clinic of Königsberg, warts are treated on psychotherapeutic lines by suggestion.

ADJUVANTS TO MAGNET POINTS FOR EXTRACTION FROM INTERIOR OF EYE. *K. Hartmann. Abstr. as follows from Klin. Monatsbl. f. Augenh., Sept., 1927, vol. 79, p. 362, in Am. Jour. Ophth., March, 1928, vol. 11, p. 264.*

A very small fragment of iron in the upper nasal quadrant of the lens was attracted by the giant magnet but fell into the lower angle and became firmly lodged in the root of the iris. All efforts to extract it were in vain until an iris forceps was introduced closed and brought into contact with the pole of the giant magnet. The fragment at once flew to the forceps and was removed without iris prolapse.

FRAGMENT OF STEEL EMBEDDED IN RETINA FOR FOUR YEARS. *L. W. Fox. Am. Jour. Ophth., March, 1928, vol. 11, pp. 220–221.*

Dr. Fox reports the history of a case which came to his observation in which four years previously a fragment of steel had entered the eye of the patient and become embedded in the retina. This eye was entirely quiet when the patient came for consultation for failing sight in the fellow eye, which proved to be due to disease of the optic nerve. In the eye containing the foreign body the field was normal

except for a segment corresponding to the site occupied by the foreign body. X-ray picture was negative, but with the slit lamp the track of the foreign body could be readily traced, and with the ophthalmoscope a round area of exposed sclera surrounded by a zone of pigment, above and to one side of the disk, was visible. In the middle of this area was a rectangular greenish body set with its long axis vertical and somewhat oblique. Traumatic cataract did not develop, although there was a limited opacity of the lens. In this entire period of four years the patient had suffered no ill effects from the presence of the foreign body.—B. A.

LIGHT AND THE EYES. *O. Thies. Abstr. as follows from Zentralbl. f. Gewerbehyg., Sept., 1927, N. S. vol. 4, pp. 329–335, in Bull. Hyg., April, 1928, vol. 3, p. 293.*

The author makes an appeal for the better realization of the effects of light rays on the human eye. The eye sees but a small proportion of the actual rays of the sun, the dark rays being invisible. The visible rays appear to do no harm because the eye has a protective mechanism consisting of the lids, the iris, and the flow of tears. Both the ultraviolet and the ultra-red rays appear to affect the eyes and being invisible the eye does not set its protective mechanism in action. Examples of ultraviolet effects are sun "eclipse blindness" and glacier burns and snow blindness. In the higher altitudes there is a greater amount of the ultraviolet rays which are responsible for these eye effects. It is not only the superficial parts of the eye which are affected but the deeper structures may also be involved.

Passow states, and he is confirmed by the experiments of Vogt on guinea-pigs, that the ultra-red rays affect chiefly the deeper parts while the ultraviolet which have smaller powers of penetration affect chiefly the more superficial. Vogt produced cataract by exposure of guinea-pigs' eyes to ultra-red rays. This is of particular interest from the point of view of the incidence of lens opacities in glass workers who are exposed to considerable intensities of these rays. In this form of cataract the posterior pole of the lens is first affected perhaps because that part is not so well protected by the iris, is not bathed by the aqueous, and has not the advantage of the lymph circulation.

Ultraviolet ray effects are seen at altitudes and are similar to the *ophthalmia electrica* found in those who are exposed to the light from electric ovens, mercury vapor lamps, and X-rays. The eye disease found in film actors and operators is due to the same cause. The symptoms are blepharospasm, photophobia, lacrimation, and a feeling of grit in the eye which come on ten to twelve hours after exposure but may be delayed for some days. The eyes show inflammation of the lids and conjunctivitis. The author insists on the importance of examining these eyes with the corneal microscope, for he states that in all cases it is possible to demonstrate a burning of the cornea. The burns consist in a large number of minute blisters each surrounded by a zone of haziness. These cases occur chiefly in those who have little pigment. The treatment is the

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use of bland ointments and the use of goggles. Stress is laid on the importance of great care in the choice of protective goggles and the use in them of a type of glass which is known to protect against the particular type of ray to which the worker is to be exposed.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

ACCIDENTS IN THE "PETROVSKY" AND "LENIN" IRON FOUNDRIES IN DNEPROPETROVSK. *B. Schkljar. Gigiena Truda, 1927, no. 4, pp. 80–93.*

Data are here presented on traumatism in 1926 in the two largest iron foundries in the south of Soviet Russia, including 16,505 accidents in the "Petrovsky" foundry and 6,688 in the "Lenin" foundry. Disabilities with loss of working capacity accounted for approximately 24 per cent. in the Petrovsky foundry and for approximately 11 per cent. in the Lenin foundry. Among the women, who made up some 7 per cent. of the workers, there was a small percentage (about 1.5) of traumatism, while among the young persons there was an average of 6.5 per cent.

The departments of hot work were especially hazardous, giving 356 accidents per thousand workers with 17 per cent. of workdays lost through sickness. The largest percentage of disability with loss of capacity for work was due to injuries from blows and knocking against things, to wounds, as well as to injuries from falling objects. According to occupation, the workers who suffered the highest accident incidence were the helpers, who knew little of the conditions of the work (266 per thousand being injured in the Petrovsky foundry and 304 per thousand in the Lenin foundry), and the roll hands in the Petrovsky foundry among whom there were 676 cases of traumatism per 1,000 workers. The average loss of work in days through accidents amounted, in the Petrovsky foundry, to 1.1 per cent. and in the Lenin foundry, to 0.9 per cent. of the total working days.

In order to prevent traumatism in these foundries, sanitary and hygienic conditions must be improved, more attention must be given to accident prevention, and the interest of the workers themselves in safety methods must be aroused.—B. A.

METAL-MINE ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1925. *W. W. Adams. U. S. Bur. Mines, Bull. 282, 1927, pp. 119.*

This Bulletin contains a valuable compilation of statistics necessary for the analysis of the causes and conditions relative to mining accidents. The accidents are studied in relation to their chronologic and geographic distributions, their causes, the kind of mine, the various mining methods, their severity and fatality, and certain other factors. Most of the comparisons are made by rates based upon the number of 300-day workers.—C. R. D.

ACCIDENT EXPERIENCE AT A METAL WORKS. *S. Semovskich. Gigiena Truda, 1927, no. 5, pp. 73–82.*

Accident prevention measures introduced at a large metal works brought about a significant decrease in traumatism. The number of accidents involving loss of working capacity decreased from 7.8 per

thousand workers to 1.26; fatal accidents decreased from 0.6 to 0.1, and at the end of the year only one death was registered. On the whole, protective devices, provision of special clothing, and intelligent behavior on the part of the workers themselves have contributed to lowering the number of accidents.—B. A.

ACCIDENTS AT METALLURGICAL WORKS IN THE UNITED STATES DURING THE CALENDAR YEAR 1925. *W. W. Adams. U. S. Bur. Mines, Tech. Paper 412, 1927, pp. 39.*

Data are presented which show increased employment and a better safety record in the metallurgic industry in the United States during 1925. The death rate from accidents was reduced from 0.87 per thousand 300-day workers in 1924 to 0.66 per thousand in 1925; the nonfatal injury rate per thousand employees was reduced from 131 to 116. Reports of nonfatal accidents covered all personal injuries disabling an employee longer than the remainder of the day or shift on which the accident occurred. Fatal and nonfatal accidents combined represented a loss weighted at seventy-three days per accident, as compared with an equal loss of time per accident in 1924. Numerous statistical tables are included.—M. C. S.

PERMISSIBLE EXPLOSIVES. *P. Naoúm. Abstr. as follows from Ztschr. f. angew. Chem., 1927, vol. 40, pp. 1351–1359, in Chem. Abstr., Feb. 20, 1928, vol. 22, p. 686.*

A general review of the whole field of permissibility of explosives in gaseous and dusty coal mines. The compositions of the leading types of German and French permissibles are given, with flame photographs. The degree of safety of the French type is much less, and the flame photographs are twice as large. English and American permissibles, and permissible tests, closely approximate the German. American compositions are kept secret, so no direct comparisons can be made.

THE SAFETY IN MINES RESEARCH STATION NEAR BUXTON. *H. B. Dixon. Abstr. from Nature, 1927, vol. 120, pp. 479–481, in Chem. Abstr., Jan. 10, 1928, vol. 22, p. 165.*

An illustrated description of the buildings and equipment of this Station where explosives are tested for permissibility and investigations of explosives and explosion phenomena are carried out.

PREVENTION OF DANGERS IN OPERATION OF GAS GENERATORS. *Kattentidt. Zentralbl. f. Gewerbehyg., June, 1927, N. S. vol. 4, pp. 202–205.*

SPECIAL HAZARDS IN THE CLEARING AWAY OF STEEL MILL DUMPS. *Kattentidt. Zentralbl. f. Gewerbehyg., July, 1927, N. S. vol. 4, pp. 243–244.*

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

GAS ANALYSIS AND ELECTROCARDIOGRAPHIC STUDIES OF THE CIRCULATORY APPARATUS OF ELECTROCUTED ANIMALS. *N. Ichikawa. Ber. ü. d. ges.*

Physiol. u. exper. Pharmakol., Dec. 7, 1927, vol. 42, p. 564.

There are two views with regard to the cause of death in accidents due to electric current. According to one, death is due to primary heart failure; according to the other, it is due to paralysis of the respiratory center. In order to decide this question, which is extremely important from a practical standpoint, we should have a criterion that would still exist some time after death. We might use for this purpose the oxygen content of the arterial blood. If breathing ceases, while the heart still continues to function, we may assume that the arterial blood is strongly asphyctic. If, on the other hand, the circulation of the blood stops before breathing does, we may assume that the stagnating contents of the left side of the heart and of the large arteries lose their oxygen only slowly.

The author killed dogs and rabbits with alternating current (50 cycles, tension between 110 and 2,000 volts) and determined the oxygen content of the blood with the Barcroft differential manometer. The blood was made noncoagulable by intravenous injection of Novirudin. Special control experiments showed that the oxygen determination is practically not disturbed by this. Through observation and recording of the electrocardiograms directly after passage of the electric current, possible disturbance of the heart action was determined. The experiments showed that, when the current passed through the body—from the right arm to the left leg—and was of sufficient intensity, cardiac fibrillation always resulted. In rabbits, under special experimental conditions (2,000 volts passing from mouth to occiput), primary respiratory failure occurred; in dogs, this phenomenon was not once produced under these conditions. In fatal accidents from electric currents, therefore, primary heart failure must be considered as the cause of death.

The determination of the oxygen in the blood according to Barcroft's method showed the value of this procedure for determining the primary cause of death, for after passage of the current through the body, resulting in primary heart failure, the difference in oxygen content of the arterial blood before and after death was distinctly less than in cases where the respiratory center had failed first.—M. C. S.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

Selective Placement of Metal Workers. I. Preliminary Studies. *M. Pond. Jour Personnel Res., Jan., 1927, vol. 5, pp. 345–368.*

II. Development of Scales for Placement. *M. Pond. Ibid., Feb., 1927, pp. 405–417.*

III. Selection of Toolmaking Apprentices. *M. Pond. Ibid., March, 1927, pp. 452–466.*

This investigation of the use of intelligence tests in the selection of factory workers was made in the Scovill Manufacturing Company, over a period of two years.

Eight tests were given to all newly hired workers in the preliminary studies of the first year, and were repeated the second year. Data from 3,184 employees were analyzed. In

the preliminary study four criteria for evaluation of the tests were used, as follows: highest weekly pay, increase in earnings, foremen's ratings, and terminations of employment. The last criterion of success was made the principal one of the second study. On the basis of the technical conclusions presented, the combined scales for the sixty-five occupational groups evolved are in use provisionally in placement of employees at this Company.

In the special study of toolmaking apprentices the criterion of success used was foremen's ratings expressed in four degrees, the two highest (excellent and good) being considered "satisfactory" and the two lowest (poor and very poor), "unsatisfactory." Eight tests and a personal history questionnaire were given to three separate groups of apprentices, with excellent co-operation from the foremen. The percentage of satisfactory workers in the preferred range for total scores, as obtained from evaluation of the tests, was 82; in the non-preferred range the percentage was 23; among all the apprentices tested it was 60. "Rigorous use of this device for a year has reduced the number of unteachable apprentices among those hired from 18 per cent. to zero."—B. A.

MENTAL HYGIENE IN INDUSTRY. *C. M. Campbell. Abstr. from Industry, May 21, 1927, vol. 19, in Human Factor, July–Oct., 1927, vol. 3, pp. 9–11.*

Illustrative cases are cited by Dr. Campbell to show types of problems where the principles of mental hygiene are of importance in salvaging the worker for work, by eliminating a great deal of preventable nervous and mental distress and by giving fuller opportunities for the attainment of personal happiness and efficiency. A business man who has become an "alcoholic," an invalid dressmaker, and a skilled workman who had a very narrow life and was not physically robust are among the examples given. —B. A.

A PRACTICAL HYGIENIC MEASURE. *H. B. Elkind. Abstr. from Industry, Aug. 20, 1927, vol. 19, in Human Factor, July–Oct., 1927, vol. 3, pp. 11–12.*

Factory records showing production or output curves might well be used more generally to pick out maladjusted workers and the mental hygienist called in to suggest corrective measures.—B. A.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

STATISTICAL REPORTS OF INJURIES TO MINORS UNDER 18 YEARS OF AGE, OCCUPATIONAL DISEASE CLAIMS, ADDITIONAL AWARD CLAIMS. *Indust. Com. Ohio, Division Safety and Hyg., Special Bull. No. 1, 1927, pp. 139.*

The nature and extent of injuries to minors under 18 years of age who were injured in Ohio during the course of their employment are shown in a series of tables. During the year 1926 there were 3,692 claims filed for such injuries, of which 3,139 were for males and 553 for females. Over half of those injured in both groups were 17 years of age, the number of injuries

dropping markedly in the 15 to 13 year age groups. A number of accidents to minors occurred at oiling or cleaning machinery in motion or in operating abrasive wheels, although it is violation of the law to permit such work. Six boys were fatally injured; one girl and thirty-eight boys received permanent injuries such as loss of eyes, legs, or of one or more fingers. More than seven days' time was lost in 716 of the temporary disability cases, the average time for these cases being 25.3 days; 630 cases caused a loss of time amounting to seven days or less, while 2,301, or 62.3 per cent., of all cases involved no lost time. More than one-sixth of all cases developed blood poisoning causing more than one-fifth of all the time lost.

The metal goods industry headed the list from the point of view of frequency of accidents, being responsible for 924, but slightly over 70 per cent. of these involved no lost time; second on the list were commercial enterprises, with 675; and the clay, glass, and stone industry came third, with 369. First on the list from the point of severity was the paper and printing industry, where 16,422 days' time was lost, owing chiefly to one fatal case and six permanent injuries; commercial enterprises came second and the metal goods industry third. Handling objects caused the largest number of accidents (839), followed closely by machinery (831), with stepping on or striking against objects third (485). Motor vehicles were the cause of the greatest time loss (21,034 days), with elevators second (20,781 days), and machinery third (19,880 days). Machinery accidents are further analyzed.

The résumé of occupational disease claims reported since the inception of the occupational disease law July 1, 1921, up to Jan. 1, 1927, shows that a total of 4,443 claims have been filed. Skin diseases resulting from occupation were responsible for the greatest number of claims filed, with a total of 3,005, of which dermatitis due to handling or use of oils, cutting compounds, or lubricants, to dust, liquids, fumes, gases, or vapors claimed the largest number (2,890); a few additional cases were due to the action of benzine, gasoline, and similar compounds. Many of the cases of skin diseases were mild or of short duration, only 1,233 involving disability lasting more than seven days, with an average per case of thirty-eight days. The group responsible for the second largest number of claims (1,092) is the classification of industrial poisons, mineral (brass or zinc, lead, mercury, and phosphorus) and chemical (arsenic, benzol or derivatives, aniline, carbon bisulphide, wood alcohol, carbon dioxide, and volatile petroleum products). In this group lead was the cause in the largest number of claims, with a total of 907 of which 759 show a disability lasting over seven days and 37 are reported as fatal, only 65 showing no time lost. The number of days lost due to lead poisoning was 277,112—the largest total of days lost of any single disease in the entire list of occupational diseases. Claims were filed for 336 cases which could not be classified under the provisions of the present law and for which payment of compensation and medical expense were therefore denied.

The total compensation paid for the

total of 4,107 classified cases was $369,942, of which $178,743 was for fatalities, $2,890 for permanent disability, and $188,309 for disability lasting over seven days. Total compensation paid for skin diseases was $82,682, approximately $37,500 of which was for dermatitis due to dust as an irritant. Of the total of $280-070 in compensation awarded claims for industrial poisoning, $241,760 went for lead poisoning, the next largest amount being $17,773 for poisoning due to benzol or its derivatives. Total medical cost of all claims granted was $98,866, of which approximately $45,-300 went for skin diseases and $46,400 for lead poisoning. Ten claims for bacterial infection due to anthrax and glanders were filed—medical costs were paid in all cases; compensation was granted only in cases of anthrax due to handling hair bristles.—B. A.

Compensation for Extrahazardous Industries Which Insurance Carriers Refuse to Cover. *B. H. Handy. Proc. Fourteenth Ann. Meeting Internat. Assn. Indust. Accident Boards and Commissions, U. S. Bur. Labor Statistics, Bull. No. 456, Feb., 1928, pp. 64–69 (discussion pp. 69–80).*

Factors Influencing the Disability Period Following Industrial Injuries. *C. W. Roberts. Proc. Fourteenth Ann. Meeting Internat. Assn. Indust. Accident Boards and Commissions, U. S. Bur. Labor Statistics, Bull. No. 456, Feb., 1928, pp. 117–123 (discussion pp. 124–129).*

Workmen's Compensation Legislation in Relation to Vocational Rehabilitation. *Federal Board for Vocational Educ., Bull. No. 126, Dec., 1927, pp. 141.*

This bulletin has for a subtitle: "An Analysis of Certain Provisions of Workmen's Compensation Laws Showing their Relation to the Administration of Vocational Rehabilitation of Disabled Persons." No attempt is made to analyze the compensation laws of the several states in all their provisions, the aim being rather to enable rehabilitation officials to "become more thoroughly familiar with those sections of the laws that have a direct relation to rehabilitation" and thus assist in making more effective their advice to disabled persons "both as to compensation benefits that might be due them and as to rehabilitation service that might be rendered."

The bulletin is presented in five sections giving (1) a description of co-operative relations now being maintained in four selected states (New York, Ohio, Wisconsin, and Utah) embodying types of working relations; (2) fundamentals of effective co-operation between rehabilitation and compensation agencies; (3) an analysis of such provisions of the state compensation laws as those providing for medical benefits, artificial appliances, awards for temporary and permanent disabilities, for second major injuries, and for rehabilitation; (4) a summary analysis by states of compensation laws; and (5) a tabular comparison of the principal sections of compensation laws having a direct relation to state vocational rehabilitation programs.—B. A.

The Physician and Workmen's

COMPENSATION. *H. H. Kessler. Jour. Am. Med. Assn., March 17, 1928, vol. 90, pp. 825–827.*

This is a plea for physicians to familiarize themselves with the various features of the compensation laws, especially with the medical provisions of these acts.—K. R. D.

REHABILITATION OF DISABLED EMPLOYEES

REHABILITATION OF PHYSICALLY HANDICAPPED. *H. H. Kessler. N. J. Med. Soc. Jour., Feb., 1928, vol. 25, p. 85.*

SHELTERED EMPLOYMENT FOR THE TUBERCULOUS IN THE UNITED STATES. *H. A. Pattison and P. P. Jacobs. Nat. Tuberc. Assn., Tech. Series No. 7, 1927, pp. 80.*

The tuberculous patient leaving the sanatorium, as well as the community to which he is returning, is confronted with three problems: the best method of making a mental and physical adjustment to his new environment which is of an entirely different character from that of the sanatorium; selecting the most suitable employment; and securing adequate medical supervision.

In an endeavor to solve these problems a number of experiments and demonstrations in sheltered employment have been established and carried on for several years in different parts of the United States. This report outlines in some detail the methods and results of some of the best known of these—Altro Work Shops, Tomahawk Lake Camp, Reco Manufacturing Company, Phipps Institute Workshop, Central New England Sanatorium and Industrial Colony, and Potts Memorial Hospital—and attempts to evaluate them as part of the whole scheme of anti-tuberculosis work.

This publication should be of value to all who are interested in the after-care of the tuberculous.—M. C. S.

THE WORKING CAPACITY OF THE TUBERCULOUS. *G. Thorburn. Am. Rev. Tuberc., March, 1928, vol. 17, pp. 297–306.*

The author gives in brief a few of the interesting conclusions which the Vocational Bureau of the New York Tuberculosis and Health Association has drawn from its experience in securing work for and in keeping at work 676 patients with inactive tuberculosis, and presents his own personal views based on his experience with the Reco Shop and on his own practice. For these patients the Bureau banned work of a heavy manual type, such as dusty trades, grinding or polishing; work that necessitated considerable physical exertion, such as soliciting, collecting, food handling; work in contact with children; and work that brought the patient in close personal contact with the customer, such as barbering, manicuring, etc. An effort was made to use the men's previous training and ability, and to place them in an organization where the employer was sympathetic, and in a type of work that was noninjurious. Patients were placed as fountain pen chasers, radio assemblers, office clerks, handy men, wrappers and labelers, elevator operators, and salesmen; also in clerical and nursing positions in sanatoriums.

Comparative examinations of 449

of the 676 patients placed, made after a period of from three months to three years, showed that 42.5 per cent. had remained the same, 33.3 per cent. had improved, and 24.2 per cent. had retrogressed or died. Comparison of a group of eighty patients who had been under the medical and vocational supervision of the Bureau for a year or more with a group of thirty-nine under observation less than a month but for whom the period of time between the first and final examinations was one year or more showed 35 per cent. more patients whose disease was the same or better in the supervised group than in the unsupervised.

The Bureau aimed to classify the tuberculous employee into three groups with subdivisions, according to whether the patient was suitable for (1) full time work, (2) standing or sedentary full time work near home, and (3) part time work. Regarding the last classification, it is the author's experience that part time work is usually impossible to procure and that, if obtained, it pays so poorly as to be of but little help. It is suggested that if more occupational therapy, shop training, etc., were done in sanatoriums the problem of getting patients back to work would be facilitated and their chances of being able to carry on would be enhanced.—M. C. S.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

MORTALITY AND MORBIDITY STATISTICS. NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, 1926. *Health, Commonwealth of Australia, Sept., 1927, vol. 5, pp. 147–149.*

This very condensed report gives data representing the third year's investigation (see abstract in THIS JOUR., 1927, vol. 9, p. 233). Among a total of 42,198 employees, the average duration of sick leave per employee per year was 3.8 days, excluding absences of three days and under and accidents on duty. This average compares with one of 3.6 in 1925 and 3.24 in 1924. In 1926 sick leave of more than three days' duration was taken by 27.1 per cent. of the employees, as compared with 22.2 per cent. in 1925, the average duration of sick leave per case being fourteen days in 1926 as compared with sixteen days in 1925. As in the two previous years, influenza and other epidemic, endemic, and infectious diseases accounted for the largest incidence—105.5 cases per thousand employees in 1926, 46.7 per thousand in 1925, and 68.4 per thousand in 1924. Apart from the increase in cases in this disease group for 1926, the morbidity incidence for the three years is similar. Mortality figures showed a rate of 4.2 per thousand employees in 1926, 3.9 in 1925, and 3.7 in 1924.—B. A.

THE ILLNESS RATE AMONG MALES AND FEMALES. HAGERSTOWN MORBIDITY STUDIES NO. VI. *E. Sydenstricker. U. S. Pub. Health Rep., July 29, 1927, vol. 42, pp. 1939–1957.*

In addition to figures for the general population, three series of ratios are given which concern wage earning males and females. The first was computed from the sickness rates for eleven large establishments, each covering an experience of five years.

The sicknesses included only those causing disability for eight days or longer, excluded causes and conditions peculiar to females, and involved certification of sickness. In half of the establishments the rate among females was definitely higher than that among males; in three the rate was about the same; and in two the male rate was higher than the female. The nature of the men's work and their working conditions in most of the plants, however, were quite different from those of the women.

The second series of ratios was based on the experience of the Hood Rubber Company, where work and working conditions are fairly similar for males and females. The sicknesses included are those which disabled the workers for at least two consecutive working days and were, in almost every instance, reported upon by a nurse employed by the Company. For every absence due to sickness among males there occurred 2.18 absences among females.

Ratios computed from the records of the Edison Electric Illuminating Company of Boston for a ten-year period showed that there were annually 2.02 absences due to sickness among females to every absence among males.

A table is given comparing the sex ratios for the Hagerstown population of working ages and the Edison Company employees with respect to certain groups of diseases and conditions. On the assumption that the two sets of data are roughly comparable, the author makes the following observations:

> The low ratio of the female sickness rate to the male rate in the Edison group for general diseases, diseases of the circulatory system, nonvenereal diseases of the genito-urinary system, and diseases and defects of the bones and organs of locomotion, as compared with the Hagerstown population, may be interpreted, perhaps, as reflecting a greater degree of selection (whether natural or deliberate or both) of females for industrial employment than of males. This would suggest itself as the obvious reason for the low illness sex ratio for nonvenereal diseases and conditions of the genito-urinary system among the employed persons, and the lack of occupations for women who are crippled may be a reason for the low illness sex ratio for diseases and defects of the bones and organs of locomotion among the employed persons. Whether or not the low ratios for general diseases and diseases of the circulatory system reflect a similar fact is an interesting question upon which our data can contribute no direct information.
>
> Again, in view of the facts that the Hagerstown female-male ratios for sickness are magnified by reason of the method of securing the record and that the Edison ratios are probably lessened by reason of the factor of selection, the suggestion presents itself that the ratio of the female sickness rate to that of the male rate is higher for a group of factory workers than for a general population group. For the Hagerstown adult group a ratio of about 1.3 to 1 was found when the same method of reporting was applied to both sexes. For the Edison group the ratio was found to be nearly 2 to 1. This indication that females are less able to withstand factory work can not be accepted as worth more than a mere suggestion for further inquiry, although it is in line with certain studies of mortality records. —M. C. S.

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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GENERAL

OCCUPATIONAL HEALTH OF WORKERS EMPLOYED ON DREDGING MACHINES. *S. Mallov. Gigiena Truda, 1927, no. 6, pp. 26–36.*

A study was made of the workers employed on a dredger in the canal at the entrance of Taganrog Bay. The dredger lies at anchor, like a great boat, raising sand from the sea floor by means of a special scoop with movable bottom and pouring it into special boats lying by. The workers and officials live either in rooms in the dredger or in the boats. Those living in the dredger—thirty-five persons—are exposed to specific industrial hazards during the course of twenty-four hours (the work was carried on without interruption in three shifts); injury to the hearing was caused by friction of the moving parts of the machine, by the deafening noise of the falling scoop, and by the periodic constant vibration of the whole machine. Since this kind of work is removed from civilization, the workers seldom go ashore.

Medical examination of those living on the dredging machine showed impairment of hearing, of sound conduction, and of the limit of audibility of high tones for almost all the workers;

a great number of cases of nystagmus; changes of the visceral nervous system in the way of a vascular hypertension with increased dermographism, increased nervous excitability with hysteroneurasthenic symptoms. The auditory and neuropsychical changes are directly dependent upon the length of time a man has been working on the dredger.

As the result of these findings, the following recommendations are made: complete prohibition of the workers' living on the dredger when the machine works more than eight hours in the course of the twenty-four; accommodations for living on the guard ship and possibly on shore; permission to go on shore daily or at least periodically; provision of clubs and places of recreation on shore or on the guard ship; medical examination of newly engaged workers.

Some of these demands have already been put into practice and have had a beneficial influence on the condition of the worker.—M. G. P.

THE SANITARY WORKING CONDITIONS OF FOUNDERS. *A. Semenov. Gigiena Truda, 1927, no. 6, pp. 42–45.*

Quantitative and qualitative determinations of the gas and dust in the air of foundry workshops in several factories were made by the author. The average dust concentration was found to be 65 mg. per cubic meter of air, with wide fluctuations above and below that figure. Of the gases, sulphur dioxide (from 0.009 to 0.036 mg. per cubic meter of air) and carbon monoxide (in several workshops up to 0.43 mg. per cubic meter) held first place. The highest figures were found in immediate proximity to the molds.

Sickness incidence in one of the factories inspected was as follows: 53.8 per cent. of all founders showed anemia; in 18.8 per cent. the gastro-intestinal canal was affected, in 28.7 per cent. the vascular system, and in 40 per cent. the respiratory organs; 10.2 per cent. complained of headache and dizziness.—M. G. P.

INDUSTRIAL HYGIENE IN THE BELGIAN CONGO. *Abstr. as follows from Rap. sur l'hyg. pub. de la colonie du Congo belge pendant l'année 1925, pp. 17–19, in Bull. Hyg., March, 1928, vol. 3, p. 219.*

Industries in the Belgian Congo have not yet developed sufficiently to enable the principles of industrial hygiene to be far advanced in any of the provinces of Kasai, Katanga, or the eastern province. The problems facing the hygienist are concerned rather with housing native workers than with the environment of labor; hence this report deals with camps and food. In order to insure the consumption of sufficient food, the best practice appears to be to give, in return for work done, equal parts of money and food. In Katanga the ration adopted has been on the basis of 3,500 calories daily, made up of 480 calories from proteins, 810 calories from fats, and 2,200 calories from carbohydrates. The main industries would appear to be railway work, employment in getting mineral ores and by a coal company. Doctors have been appointed to supervise the recruiting and health of native labor. The report under notice is based mainly upon information received from these medical men. Again and again the remark appears that the conditions leave much to be

desired and that there is considerable room for improvement. Nevertheless the conditions for labor employed by the government appear to be fairly satisfactory and great advance is being obtained year by year in the mortality which is experienced. Thus in the province of Katanga a mortality estimated at 106 per thousand in 1917 was reduced to thirty-three in 1920. The diseases causing most mortality among the native labor are pneumonia and dysentery. [No reference is made to the occurrence of miners' phthisis in the mineral mines.]

LABOUR PROBLEMS IN SOUTHERN AFRICA. *H. P. Butler. Internat. Labour Rev., April, 1928, vol. 17, pp. 465–485.*

The bearing of this excellent review of the position today in southern Africa upon industrial questions is considerable. It shows how intricate are the problems involved in a country where the balance of numbers between Europeans and natives approaches the reverse of the balance existing between Europeans and negroes in the United States. The industries of southern Africa today are mainly agricultural; even here modern methods are calling for more labor. But other industries are steadily developing; the greatest is that of the gold mines of the Rand, where about 200,000 natives are employed with 20,000 whites. The problem for the natives is the more difficult in that most of them stay for six months or so and then return to their native villages. In this industry there exists that most deadly of occupational diseases, miners' phthisis, concerning which a proposal is mentioned that an international meeting of experts may be called, to discuss its pathology and prevention, at Johannesburg. At present the disease is compensated out of a fund levied on the industry. Throughout the Dominion, as the native becomes more skilled, he shows a tendency to invade the occupations previously monopolized by white men. At the same time, as his standard of living is at present so low, he tends to lower the price of the white man in the labor market. A long view of the position perceives that the native finally will rise to a social grade where he requires the same social comforts as the white; this is as yet far away, but the opinion is given that the white man has less to fear from an improvement than from a deterioration in the economic status of the native. How the difficulties are being faced in different parts of the Dominion, and also in southern Rhodesia, is well set out by one who has recently been through the country and gathered his information at first hand. Many of the problems are now becoming world wide, and international organization may be needed to solve them.—E. L. C.

INDUSTRIAL DISEASES: ANALYSIS OF FACTORY INSPECTION REPORTS, 1923: I. *Internat. Labour Rev., April, 1928, vol. 17, pp. 542–565.*

Some analysis is given in these pages of factory inspection reports with special relation to the occurrence of industrial diseases. The disease to which particular reference is made is lead poisoning, which practically monopolizes the information brought together. In Australia, it is true, work in connection with silicosis is reported, and from Belgium references are made to mercury poisoning and to the occur-

rence of ankylostomiasis. We note also with interest the occurrence of forty-two cases of miners' nystagmus in New South Wales between 1920 and 1923. When we turn to lead poisoning we find that in France 1,025 cases were notified during 1923, of which 249 originated in accumulator factories, and 278 in metal enameling works; these figures are reminiscent of the position which prevailed in Great Britain in 1900. The figure given for Great Britain is 337 for 1923. Rather detailed information is presented for Switzerland, particularly with regard to substances which caused dermatitis. Information is also given as to the occurrence of lead poisoning in various industries in Austria, and with greater detail for various parts of Germany. The process of breaking up warships painted with lead paints is productive of trouble, particularly during the breaking up of English warships, whose armored plating was especially thickly coated with lead paint. Where this work was done in dry dock with adequate holes for ventilation cut in the sides of the ship there was less trouble. A new process of metallization by pulverization of lead, by the Schoop spraying process, caused trouble, and workers now wear air-tight helmets with a fresh air supply. The manufacture of accumulators, as usual, led to poisoning, particularly when a number of new workers were engaged, which was necessitated when accumulators were needed for miners' electric lamps in place of the old petrol lamps. The information given is already condensed, and for the most part only tells again the story of the occurrence of lead poisoning in such industries as lead smelting, pottery, painting, the manufacture of paints, and the printing industry. Such facts do not lend themselves to summary.—E. L. C.

OCCUPATION AND HEALTH. *Brochures No. 82–87. Internat. Labour Office, 1928.*

The subjects contained in this cover are: Accumulators (Storage Batteries); Acetylene; Aniline; Arseniuretted Hydrogen; Aviation or Aviators' Sickness; Tetra-Ethyl Lead.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

CASE OF LETHAL POISONING PROBABLY CAUSED BY ARSINE. *E. Laborde. Abstr. as follows from Ann. méd. légale criminol. police scient., 1927, vol. 7, pp. 651–654, in Chem. Abstr., March 20, 1928, vol. 22, p. 999.*

Of two workmen who had cleaned sludge out of a tank which had contained sulphuric acid with 0.1 per cent. arsenic, one had slight gastro-intestinal troubles and light bronchitis while the second died in forty-eight hours. Analysis of the viscera showed the presence of arsenic in quantities which, though small, were larger than the normal arsenic content of human viscera. From the postmortem examination and the circumstances of the case, Laborde concludes that death was due to arsine, probably evolved by action of the arsenic in the sulphuric acid on finely divided iron in the sludge.

ARRANGEMENT AND ERECTION OF SAFE BENZINE APPARATUS. *J. Schischkin. Gigiena Truda, 1927, no. 6, pp. 93–96.*

An apparatus is illustrated which serves for warming the calender rollers used in bleaching and dyeing. The apparatus consists of a small double-walled kettle. Into the inner kettle benzine and air are drawn through a tube under a pressure of about 30 mm. of water; between the walls of the kettle, steam for heating and evaporating the mixture is introduced. The gas formed in the inner kettle is led out to the calender rollers by means of a short tube. A separate apparatus is set up for every calender. With this contrivance, uniform evaporation of benzine is obtained, and it is unnecessary to maintain a high pressure in the gas tube. Thus safe working conditions are secured in such plants.—M. G. P.

THE PROBLEM OF AUTOMOBILE EXHAUST GAS IN STREETS AND REPAIR SHOPS OF LARGE CITIES. *J. J. Bloomfield and H. S. Isbell. U. S. Pub. Health Rep., March 30, 1928, vol. 43, pp. 750–765.*

The authors summarize this study as follows:

This survey was undertaken to ascertain whether or not a health hazard from carbon monoxide existed in the streets of our large cities, inside of autobusses, and in repair shops. Fourteen of the largest cities in the country were visited, having a combined population of over 19,000,000, and 250 samples of air were obtained for carbon-monoxide analysis. These samples were analyzed by the iodine-pentoxide method, using a liquid-air cooling tube which was shown to be necessary in order to eliminate gasoline vapor, a substance which tends to vitiate the results of the analysis. Our street samples were taken in such a manner as to approach the most congested conditions that may exist at a busy traffic intersection. Hence, it is felt that these results indicate the maximum hazard from automobile exhaust gas that may exist to-day in our metropolitan thoroughfares. The average of 141 tests made in city streets at peak hours of traffic showed a contamination of 0.8 part of carbon monoxide per 10,000 parts of air. Only 24 per cent of all the street samples had more than 1 part of carbon monoxide in 10,000 of air, and in only one location, a covered passageway, was there as much as 2 parts per 10,000. Samples taken inside of autobusses yielded even lower concentrations of carbon-monoxide gas. The figures for street air, when viewed in the light of present day standards of exposure to carbon monoxide, do not reveal the existence of a health hazard from this source in our city streets. The only individual who may possibly be exposed to a health hazard from inhaling street air containing automobile exhaust gas is the traffic officer. This potential hazard may be minimized by diminishing the duration of exposure at the most congested traffic stations.

Of the 102 tests made in 27 garages in the 14 cities visited, the average carbon-monoxide content was found to be 2.1 parts in 10,000. More than half of the samples (59 per cent) contained over 1 part of carbon monoxide, and 18 per cent of all the samples contained over 4 parts of this gas in 10,000 parts of air. These results for repair shops show a dangerous condition that demands the serious consideration of those concerned. This hazard in repair shops may be reduced to a minimum by not allowing the motors of automobiles to run longer than 30 seconds unless the car is in necessary motion or the exhaust is connected to the outside air by a direct air-tight outlet of ample caliber. Without such outlet no automobile engine should be allowed to run indoors, except to reach its berth or to leave by the shortest route. All of these samples were taken in garages of considerable size. The great danger to life is unquestionably in the small private garage containing one or two cars. Under

any circumstances the discharge of an automobile exhaust into a roofed inclosure should be regarded as a hazardous act.

CARBON MONOXIDE POISONING IN AUTOMOBILE GARAGES. *Mätje. Abstr. from Zentralbl. f. Gewerbehyg., Aug., 1927, N. S. vol. 4, pp. 275–277, in Bull. Hyg., March, 1928, vol. 3, p. 237.*

In consequence of several cases of carbon monoxide poisoning with two deaths in garages in Hanover from the exhaust gases when the engine was allowed to run free, the author undertook analyses of these gases under differing conditions of (1) motor spirit; (2) load; and (3) the vapor and air entering. The results showed clearly that when the engine ran free carbon monoxide was always present in the exhaust gases and, with pure benzine as the motor spirit, reached nearly 10 per cent. The proportions found under unfavorable conditions of running were hardly less than those in ordinary illuminating gas, but without the empyreumatic substances which call attention to the latter.

The authorities in Hanover now require in every garage metal piping or flexible piping for the purpose of connecting one end of this with the exhaust pipe, the other end being carried to the outer air through a small hole in the wall.

THE DETERMINATION OF CARBON MONOXIDE IN MINES WITH THE "IODINE PENTOXIDE" DETECTOR. *G. S. McCaa and J. A. Davis. U. S. Bur. Mines, Circ. No. 6057, Jan., 1928, pp. 5 (mimeographed).*

The iodine pentoxide detector consists, in its essential features, of "a small glass tube containing granular pumice stone impregnated with a mixture of iodine pentoxide and fuming sulphuric acid. . . . . When air containing carbon monoxide is forced through the tube by means of a rubber aspirator bulb and suitable valves, iodine is liberated and the original white of the granules is changed to various shades of bluish green or even violet-brown or black, depending upon the amount of carbon monoxide. . . . . The color imparted to the granules, unless produced by high concentrations of carbon monoxide, fades rapidly after each test, and a tube ordinarily may be used seven or eight times before its effectiveness is destroyed."

This method of determining carbon monoxide in mine air is adapted for field work, because the instrument is light and compact and determinations can be made quickly, simply, and with reasonable accuracy. Complete instructions in the use of the detector are given. It is pointed out that "the detector does not indicate a deficiency of oxygen in the atmosphere or the presence of such other gases as carbon dioxide and hydrogen sulphide."—M. G. P.

CONCERNING THE METHODOLOGY FOR ESTIMATION OF CARBON MONOXIDE IN THE AIR OF FACTORY ROOMS. *M. Grodsovsky and A. Bunejev. Gigiena Truda, 1927, no. 6, pp. 3–18.*

The old methods for estimation of carbon monoxide do not permit quick disclosure of poisonous concentrations of the toxic gas nor do they give exact quantitative figures for its distribution in different zones in connection with the occupational process. As a result they do not suffice for data on

industrial hygiene. Moreover, every method of carbon monoxide estimation under industrial conditions must make it possible to isolate such admixtures in the air as have a distorting influence on the results of the analysis through causing mistakes in the specificity of the carbon monoxide reaction.

As an absolute method for this purpose, liquid air is to be considered. Owing to the difficulty of its use, however, tests of several absorbents were made which showed Russian activated carbon to be absorptive, while silica gel, *Hoswei* reagent, and bisulphite did not absorb carbon monoxide. The latter were therefore suggested for preliminary absorption of sulphurous compounds, some hydrocarbons, acetylene, and aldehydes.

For the purpose of testing the method of analysis, a process has been worked out for obtaining an accurately calculable dilution of the air with carbon monoxide. The process is as follows: In a glass (B) of known capacity a known quantity of lead formate is decomposed by sulphuric acid by heating in an oven by means of an electric current; this yields stoichiometrically a determinable amount of carbon monoxide. After sufficient concentration is obtained, it is analytically tested.

For a quick method of estimation of carbon monoxide silver nitrate is dissolved in alkali-ammonia in small Wilhelmi tubes and titration made by means of a Bunshe burette.

For an accurate qualitative analysis of small amounts of air a process has been worked out with platinized asbestos whose catalytic qualities permit rapid oxidation of carbon monoxide to carbon dioxide. Separation of the carbonic acid formed is complete —it is absorbed by barium hydroxide solution (1 c.c. to 0.1 c.c. of carbon dioxide) and titrated with oxalic acid of the same strength. Instead of every time taking a liter of air from the workplace and then testing it in the laboratory, the vacuum principle is used which permits the immediate oxidation of the carbon monoxide and the estimation of carbonic acid: A Woulfe bottle (A) which is free from carbonic acid and contains a known quantity of barium hydroxide solution is pumped out by a water jet pump to a determined pressure which can be read on the vacuum manometer. Then the air is displaced by that to be examined. The carbonic acid in the bottle (A), containing the carbon monoxide, is collected with the barium hydroxide solution and back-titrated with the oxalic acid. Amounts up to 1 liter give an accuracy on analysis up to 0.001 per cent. of carbon monoxide. —B. A.

WORKING WITH COMPRESSED CHLORINE GAS IN PRACTICE. *R. Freund. Abstr. as follows from Chem.-Ztg., 1928, vol. 52, pp. 33–34, in Chem. Abstr., May 10, 1928, vol. 22, p. 1656.*

Methods for handling chlorine in commercial cylinders, tank cars, etc., are outlined. Precautions are given for guarding against accidents, and specific instances of means taken to meet emergencies are cited.

HYDROGEN SULPHIDE—THE MECHANISM OF ITS TOXICITY. *Rodenacker. Zentralbl. f. Gewerbehyg., Oct., 1927, N. S. vol. 4, pp. 372–377; Nov., 1927, pp. 405–409.*

Hydrogen sulphide is a cell poison. Changes in the blood cells are apparent with the minimal dose of 0.15 volume per thousand. With strong doses an increase in the red cell count to between 5,000,000 and 6,800,000, change in the spectral bands, and loss of oxidative power of the blood occur. No changes are apparent in either the central nervous system or the skin. It is characteristic that absorption of the poison may occur through the unchanged skin as well as through the alimentary and respiratory tracts.—L. T. F.

POISONING FROM HYDROGEN SULFIDE. *H. C. Fowler. Abstr. as follows from Oil and Gas Jour., 1928, vol. 170, no. 36, pp. 173–174, in Chem. Abstr., April 20, 1928, vol. 22, p. 1417.*

General characteristics, physiologic action, and treatment of hydrogen sulphide poisoning are discussed.

THE LIMIT OF USEFULNESS FOR GAS MASKS WITH CHEMICAL FILTERS. *W. Haase-Lampe. Abstr. as follows from Ztschr. f. d. ges. Schiess- u. Sprengstoffw., 1928, vol. 23, pp. 69–70, in Chem. Abstr., May 10, 1928, vol. 22, p. 1637.*

Two types of gas mask are described. One type provides its own supply of oxygen, eliminates carbon dioxide, and is independent of the outside atmosphere. The other type, which uses chemical filters to remove noxious gases, is safe only as long as the oxygen content of the air is 15 per cent. or more.

THE MILITARY AND SANITARY BASIS OF GAS DEFENSE. *Chlopin. Abstr. as follows from Ztschr. f. d. ges. Schiess- u. Sprengstoffw., 1927, vol. 22, pp. 333–672; 1928, vol. 23, pp. 29–33, in Chem. Abstr., April 10, 1928, vol. 22, p. 1200.*

Chlopin discusses the laws of absorption, the various types of Russian, German, French, British, and American respirators; protection against toxic smokes; protective devices for animals; protective clothing; and protective skin ointments.—P. D.

OCCUPATIONAL DISEASES IN THE U. S. NAVY. *Abstr. as follows from Ann. Rep. Surgeon General, U. S. Navy, 1927, p. 245, in Am. Jour. Pub. Health, March, 1928, vol. 18, p. 371.*

Carbon monoxide, illuminating gas, etc.—There were 6 admissions and 5 deaths. In 1 case, poisoning was reported as complicating another disease or condition. Illuminating gas escaping from a heater was reported as responsible for 2 deaths, gas from a range for 2, and gas from a jet for 1. One patient poisoned by carbon monoxide recovered.

Poisoning by volatile substances, bilge gas, etc.—Admissions were reported as follows: bilge gas, 3; copper and zinc fumes, 1; mariahuana plant, 1; trinitrotoluene (T. N. T.) fumes, 2; and turpentine fumes, 1.

Poisoning by lead.—There were 37 admissions. Fifteen cases of acute poisoning by lead paint, manner not specified, were reported, and 5 cases were reported in which acute poisoning was attributed to particles or dust from paint. Nine cases of chronic lead poisoning caused by paint were reported.

THE INJURIOUS EFFECTS OF CHEMICALS ON HEALTH WITH REFERENCE TO THE INDUSTRIAL RESPIRATORY DIS-

EASES. *F. Pohl. Abstr. as follows from Ztschr. d. Ver. deutsch. Ing., 1928, vol. 72, pp. 76–80, in Chem. Abstr., April 20, 1928, vol. 22, p. 1417.*

A comparison of the deaths and cases of sickness due to the various industrial poisons. Lead and its compounds seem to be the most important cause.

HEMATOPORPHYRIN IN URINE IN CHRONIC LEAD POISONING. *S. Hirschhorn and W. Robitschek. Abstr. as follows from Ztschr. f. klin. Med., Nov. 29, 1927, vol. 106, p. 664, in Jour. Am. Med. Assn., March 10, 1928, vol. 90, p. 815.*

Hirschhorn and Robitschek studied seventy-seven cases of chronic plumbism, including fifty reported on by Sternberg, and found hematoporphyrin beyond the normal limits in six. In eleven cases it was abundant, but within normal limits. There was no evidence that it paralleled the severity of the symptoms, but with a relatively high urinary hematoporphyrin a decrease in the number of erythrocytes and in the hemoglobin percentage was always present. The relations between chronic lead poisoning and hematoporphyria were studied, and the authors conclude that in both chronic lead poisoning and congenital hematoporphyria the hemoglobin released by the increased disintegration of erythrocytes becomes the mother substance of hematoporphyrin.—K. R. D.

THE EXPERIMENTAL PRODUCTION OF BASOPHILIC GRANULAR ERYTHROCYTES BY MEANS OF MOIST HEAT. A CONTRIBUTION TO THE VALUE OF PUNCTATE RED CELLS IN THE EARLY DIAGNOSIS OF LEAD POISONING. *H. Lehmann. Arch. f. Hyg., 1928, vol. 99, no. 5–6, pp. 181–195.*

In guinea-pigs subjected to moist heat, a blood picture was produced which resembled that in lead poisoning with respect to basophilic granular erythrocytes. The author concludes, therefore, that in occupations where workers are exposed to high temperatures and high humidities the effect of these factors may occasion a further source of error in the early diagnosis of lead poisoning on the basis of the blood picture.

A photographic method has been developed for microscopic investigation of erythrocytes with particular reference to the cell count.—L. T. F.

AN INVESTIGATION OF THE BLOOD CELLS OF SHEEP, TOGETHER WITH A CONTRIBUTION ON LEAD POISONING IN ANIMALS. *H. Rupp. Arch. f. Hyg., 1928, vol. 99, no. 5–6, pp. 165–180.*

This investigation relates chiefly to the resistance of the erythrocytes of sheep, chronically poisoned with lead, toward hypotonic salt solution, saponin, sodium hydroxide, and specific hemolysin. There was noted an increase in resistance toward hypotonic salt solution. In one of the animals there was a marked decrease in resistance, following severe poisoning, with aplastic anemia. Specific hemolysis was related to the increased resistance. It was noted that the condition of the erythrocytes, as well as their absolute number, is of great importance with respect to the Wassermann reaction.—L. T. F.

THE PREVENTION OF LEAD POISONING IN PIGMENT FACTORIES. *F. Pohl.*

Abstr. as follows from Farben-Ztg., 1927, vol. 32, pp. 1792–1793, in Chem. Abstr., March 10, 1928, vol. 22, p. 876.

Pohl gives a review of the symptoms of lead poisoning and the means of preventing the latter.

LEAD-CONTAINING SAND AS A CAUSE OF LEAD POISONING. *I. Werner. Abstr. as follows from Deutsch. med. Wchnschr., 1928, vol. 54, pp. 103–104, in Chem. Abstr., April 10, 1928, vol. 22, p. 1200.*

Three cases of lead poisoning are reported which occurred among sand blasters using sand containing lead.—P. D.

LEAD POISONING AMONG RIVETERS. *W. K. Frankel. Abstr. as follows from Deutsch. med. Wchnschr., 1928, vol. 54, pp. 104–106, in Chem. Abstr., April 10, 1928, vol. 22, p. 1200.*

Report of a case.—P. D.

A NEW TEST FOR INDUSTRIAL LEAD POISONING: THE PRESENCE OF BASOPHILIC RED CELLS IN LEAD POISONING AND LEAD ABSORPTION. *C. P. McCord. U. S. Bur. Labor Statistics, Bull. No. 460, April, 1928, pp. 33.*

The results obtained by the author indicate that the number of basophilic red cells in normal adults is commonly less than 1,000 per cubic millimeter of blood and rarely rises to 5,000 per cubic millimeter, while clear-cut cases of lead poisoning invariably show basophilic red cell counts in excess of 7,000 per cubic millimeter. Treatment with substances which promote the excretion of lead leads to a marked diminution in the number of basophilic red cells.—L. T. F.

MICRO-ESTIMATION OF LEAD (AN AID TO THE DIAGNOSIS OF LEAD POISONING). *A. Seiser, A. Necke, and H. Müller. Arch. f. Hyg., 1928, vol. 99, no. 3–4, pp. 158–164.*

The method adopted by the authors is a modification of Trillat's[1] original method and consists in estimating the lead colorimetrically. After destruction of the organic material, the lead is separated and freed from traces of manganese and copper (the peroxides of which will also yield a color with the reagent), the lead is converted to lead peroxide with sodium hypochlorite, the excess of sodium hypochlorite removed by thorough washing, and the lead peroxide treated with tetramethyldiamidodiphenylmethane. The blue color which forms with the latter is compared with that produced by standard amounts of lead. Surprising amounts of lead (0.06 to 0.17 mg. per 100 c.c.) were found in the blood of lead workers.—L. T. F.

THE OCCURRENCE OF LEAD IN THE EGG OF THE DOMESTIC HEN. PART I. *W. B. S. Bishop. Med. Jour. Australia, April 21, 1928, vol. 1, pp. 480–488.*

A review is given of ways for estimating lead in organic matter, after which the author describes the method used by him—an application of the Nessler method. Details are given of the great care which must be used throughout to insure that chance contamination is not introduced by the reagents used or from the apparatus. Standard lead solutions were found to be unstable, losing their strength week

[1] Trillat, A.: Recherche du plomb et du manganèse. Compt. rend. Acad. d. sc., 1903, *136*, 1205.

by week; apparently the lead unites with silica in the glass of the containing vessel. The addition of a little glacial acetic acid stopped this loss. This communication is promised as the first of a series. Lead was found in the shell of egg, from 0.1 to 1.6 mg. per 100 gm. of wet material; in yolk, from 0.2 to 1 mg.; and in white from 0.12 to 0.48. In chick embryos the lead content varied from 0.05 to 0.5 mg. per 100 gm. of wet material. Uranium and lithium have been found in all the eggs examined.—E. L. C.

TETRA-ETHYL IN MOTOR SPIRIT. *Lancet, April 7, 1928, vol. 1, pp. 732–734.*

The second of two debates in the House of Lords is reported which took place regarding the recent introduction into England of "Ethyl" motor spirit. Much has been appearing in the public press as to possible poisoning from tetraethyl lead. An attack against its use was moved by Lord Buckmaster, to whom Viscount Gage replied for the government announcing the appointment of a strong departmental committee. The terms of reference are

To inquire into the possible dangers to health resulting from the use of motor spirit containing lead tetra-ethyl or similar lead-containing compounds, and to report what precautions, if any, are desirable for the protection of the public or of individuals in connexion with the use or handling of such motor spirit.

Throughout the debate extensive references were made to the investigations already made in the United States which have been reported from time to time in THIS JOURNAL.—E. L. C.

WORK WITH MERCURY USED IN THE MANUFACTURE OF ELECTRIC LAMPS. *A. Dmitriev. Gigiena Truda, 1927, no. 6, pp. 18–26.*

Work with mercury in the manufacture of electric lamps can be divided into two classes, from the sanitary-hygienic point of view:

1. Work which involves direct contact of greater or less duration with metallic mercury and at the same time exposure to the fumes of the mercury being prepared or used. This class of work includes the following processes: cleaning the mercury pumps, cleaning the metallic mercury, estimation of the expansion coefficients of glass, setting up the mercury pumps and fitting the different parts of the apparatus.

2. Work in which mercury is received for use in closed apparatus but in which, if the container is broken, the mercury can escape and thus evaporate. To this class of work the following processes belong: pumping out the lamps by means of mercury pumps, setting up the half-watt and gas filled lamps, estimation of the gas capacity of the glass, and preparation for the tungsten process.

Moreover persons who work in the same rooms but do not have to do with the handling of mercury are exposed to the effects of mercury fumes.

Analyses of the air of the Moscow factory "Electrolampa" No. 2 gave the largest amounts of mercury (9.37 to 15.5 mg. per cubic meter of air) in the laboratory for making special lamps, where volatilization of the mercury takes place owing to the high temperature (about 380°C.) of the gas oven; in the pumping room 13.27 to 13.58 mg. of mercury were found.

Above the table where the glass blower fitted the mercury mechanism 98.2 mg. of mercury per cubic meter of air were found. The smallest amounts were found in the air of the physical, photometric, and tungsten laboratories.

Measures have been proposed by the sanitary inspector to prevent mercury poisoning in the factory surveyed, as follows: Replacement of the mercury pumps and of the apparatus for pumping air out of the lamps by oil pumps, as has already been done in 50 per cent. of the cases; replacement of the mercury contacts in the apparatus for preparing the tungsten threads with pulverized tungsten; complete exclusion of work with mercury from the rooms where general work is going on; emptying and pouring of mercury only in isolated enclosures; and maintenance in the rooms where work with mercury is carried on of the lowest possible temperature, so that an increase of over 16 to 18°C. is not permitted.—B. A.

THE DANGER FROM MINUTE AMOUNTS OF MERCURY. *P. Fleischmann. München. med. Wchnschr., Jan. 6, 1928, vol. 75, p. 68.*

A CONTRIBUTION TO THE STUDY OF ACUTE PHOSPHORUS POISONING. *P. H. Rossier. Abstr. as follows from Schweiz. med. Wchnschr., 1927, vol. 57, pp. 890–891, in Bull. Hyg., March, 1928, vol. 3, p. 236.*

A careful account is given of the clinical symptoms and pathology of a fatal case of phosphorus poisoning which originated from a suicidal dose of 45 gm. of rat poison containing 3.5 gm. of phosphorus. Serious symptoms did not develop until after forty-eight hours when signs of jaundice and liver destruction appeared, with abdominal pains and hemolysis. An unusual feature was painful symmetrical gangrene of the feet. Death occurred eight days after the poison was swallowed. The main postmortem finding was a slightly enlarged liver with fatty degeneration. Phosphorus could not be detected chemically in the organs. Apparently sufficient time had elapsed for the phosphorus to be completely oxidized into phosphoric acid, which is a normal constituent of the body.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

SOME OBSERVATIONS ON THE RÔLE OF SPARKS IN THE MECHANICAL IRRITATION OF THE EYES IN ACETYLENE WELDING. *N. London. Gigiena Truda, 1927, no. 6, pp. 36–42.*

In a factory for the manufacture of metal vats, where acetylene welding was carried on, it was found on close examination that the lenses of the spectacles of the workers employed at autogenic welding were covered with a layer of small particles of regular spherical form and hard consistency, the diameter of most of these particles ranging from 101 to 400 microns. Chemical analysis of the precipitate showed an isomorphous mixture of iron and its oxide. Considering the melting point of iron and iron oxide, it must be assumed that the temperature of the drop at the moment of contact with the glass was

from 1,510° to 1,565°C. The hollows in the glass, which were clearly visible under the microscope, after solution of the layer of particles, showed that the sparks penetrated the glass with considerable force.

The author also experimented with glasses which were placed in a position corresponding to that occupied by the worker while welding. He concluded that, in the course of the day's work, at a height of 20 to 35 cm.—the customary height for carrying on welding—370 to 1,300 red hot metal particles of macroscopic and 2,700 to 6,500 of microscopic size are deposited in a square centimeter of surface. The macroscopic particles seldom surmount this height, but the microscopic particles are found at various heights up to 0.5 and 1 meter from the welding. Particles collect on the inner surface of the glasses because of imperfection in the framing and improper use of the glasses.

An examination of the eyes of the workers concerned (131 persons) confirmed in some degree the assumption of a traumatism of the eye resulting from sparks (one case of permanent alteration of the cornea due to the action of a foreign body and two cases of foreign substances disclosed in the cornea, unknown to the sufferer). Burns of the skin of the face and hands were not recorded.—M. G. P.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

COKE-OVEN ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1926. *W. W. Adams. U. S. Bur. Mines, Tech. Paper 427, 1927, pp. 40.*

The death rate from accidents in 1926 was 2.1 per thousand men employed, calculated on a standard year of 300 workdays per man. The nonfatal injury rate, covering all lost time accidents, was 79 per thousand. The corresponding rates for 1925 were 1.16 and 71. The increased rates in 1926 were partly accounted for by a disastrous explosion of gas at a by-product plant in Indiana.

It is estimated that all the fatal and nonfatal accidents at coke ovens in 1926 represent a loss of approximately 378,000 days, an average of 192 days for each of the 1,973 accidents that occurred during the year.

The chief causes of fatal accidents were gas explosions, falls of persons, coke cars, railway cars, falling objects, and burns. Nonfatal injuries resulted mainly from falls of persons, falling objects, burns, coke cars, and hand tools.

For the statistical details readers are referred to the original report.—M. C. S.

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formed is collected in baryta water, to which a little gum arabic has been added to keep the barium carbonate in suspension, and measured against a sodium carbonate solution of known strength titrametrically.

SAFE PRACTICES AT OIL DERRICKS. *H. C. Miller. U. S. Bur. Mines, Tech. Paper 419, 1927, pp. 69.*

Safety devices and methods are described, the acceptance and use of which by operators and workmen should be of material assistance in preventing some of the accidents which occur in the oil fields. Sections on personal cleanliness and prevention of fire hazards are included.—M. C. S.

BISULFIDE OF CARBON (CONVEYANCE IN TANK WAGONS) REGULATIONS, 1927. *Abstr. as follows from Chem. News, 1927, vol. 135, p. 255, in Chem. Abstr., Jan. 20, 1928, vol. 22, p. 319.*

A copy is given of schedules governing mechanically driven, and horse-drawn, road tank wagons and the general provisions governing their construction and operation.

DANGER IN HANDLING LIQUIDS WITH COMPRESSED AIR. *Leymann. Abstr. as follows from Ztschr. f. angew. Chem., 1927, vol. 40, pp. 1451–1454, in Chem. Abstr., Feb. 20, 1928, vol. 22, p. 687.*

In addition to the dangers due to mechanical or physical causes the transport of liquids by compressed air is sometimes subject to hazards of a chemical nature, such as explosions of detonating mixtures of air and hydrocarbons. Reports of eight accidents in handling oil, pitch, and tar have been studied, and although no general cause for the explosions has been discovered it is suggested that some at least of them may have originated in superheated air, burning carbon or oil from the compressor itself getting into the detonating mixture. It is pointed out, however, that usually heavy, high boiling hydrocarbons are the ones involved in explosions, and the lighter ones seem less liable to this danger.

QUARRY ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1925. *W. W. Adams. U. S. Bur. Mines, Bull. 286, 1927, pp. 97.*

Based on a standard year of 300 workdays per man, the fatality rate in the stone quarrying industry in the United States for 1925 was 1.78 and the injury rate, 170 per thousand employees, as compared with rates of 1.63 and 175, respectively, for 1924. Except for 1924 and 1923, the fatality rate was lower than in any of the fifteen years for which statistics are available. The injury rate was lower than it has been during the past five years.

Analysis of the statistics for the years 1911 to 1925, inclusive, by five-year periods, shows a general downward trend for fatal accidents—2.19, 2.1, and 1.78 per thousand men employed, the last figure representing a reduction of 19 per cent. from that for the earliest five-year period. Less progress has been made in the prevention of nonfatal injuries.

Interested readers are referred to the original bulletin which contains a vast amount of statistical material. —M. C. S.

TRAUMATISM AND ACCIDENT PREVENTION IN THE TOBACCO INDUSTRY. *V. Stahl. Gigiena Truda, 1927, no. 6, pp. 75–84.*

The writer discusses the accidents occurring at Leningrad factories and concludes that the conditions in regard to traumatism in tobacco manufacture are relatively favorable. He gives illustrations of the machines used in this industry and emphasizes the advantages and disadvantages of each separate device for accident prevention.—M. G. P.

THE METAL SPRAY CASTING PROCESS, THE DANGERS TO WORKERS FROM ITS USE, AND MEASURES FOR THEIR PREVENTION. *Eibel. Zentralbl. f. Gewerbehyg., Nov., 1927, N. S. vol. 4, pp. 393–399.*

In this method of casting, the molten metal is sprayed into molds through a nozzle with a pressure of such strength that all the hollow spaces in the mold become completely filled. The commonest accidents consist in burns from spattering metal, injuries to the ears from escaping compressed air, and injuries to the head, hands, and arms of the operator from rebounding of the piston rod. The health of the workers is endangered by exposure to lead and zinc fumes.

As protective measures the author suggests the use of goggles, metal shields at the sides of the mold, and metal shields with windows of strong glass, behind which the operator can stand while the process is going on. Better still would be to introduce vacuum casting machines.—M. C. S.

MEN WHO HAVE ACCIDENTS. INDIVIDUAL DIFFERENCES AMONG MOTORMEN AND BUS OPERATORS. *C. S. Slocombe and W. V. Bingham. Personnel Jour., Dec., 1927, vol. 6, pp. 251–257.*

This investigation was undertaken in behalf of the Boston Elevated Railway Company. Conclusions are given as follows:

> We have found in these studies that the following classes of men may be regarded as more than ordinarily prone to accident:
>
> 1. Those who do not operate economically, as shown by low coasting records.
> 2. Those whose record of delinquencies is long.
> 3. Older men with abnormal blood pressure.
> 4. Younger men with very limited experience.

THE STUDY OF PERSONAL DIFFERENCES IN ACCIDENT LIABILITY. *E. Farmer. Abstr. as follows from Jour. Nat. Inst. Indust. Psychol., 1927, vol. 3, pp. 432–436, in Bull. Hyg., March, 1928, vol. 3, p. 216.*

Accidents in any population at risk are not distributed by chance alone; the curve of distribution is definitely skew, due to a relatively small number of persons monopolizing an excessive number of accidents. Evidence has previously been adduced by Yule and Greenwood, and confirmed by Newbold, that each person possesses, as an individual characteristic, a definite degree of accident liability. Certain tests for accident liability have given positive results and, although they are not yet of practical utility, indicate that difference in accident liability is connected with other measurable personal differences. A positive correlation is found between the frequencies of trivial and of serious accidents, and between accidents and absence

through sickness; there is also evidence that the industrially inefficient sustain more accidents than others. The mental and physical make-up associated with a high accident rate cannot yet be predicted with certainty. Possibly a particular make-up protects against accidents. The scope for further inquiry is wide.

INDUSTRIAL SURGERY

HERNIA IN EMPLOYEES OF GRINDING WHEEL FACTORY. *W. I. Clark. Abstr. as follows from Boston Med. and Surg. Jour., Jan. 12, 1928, vol. 197, p. 1314, in Jour. Am. Med. Assn., Feb. 18, 1928, vol. 90, p. 572.*

In an industry in which work is laborious, 6.75 per cent. of the workers with weakness in the inguinal region developed hernia. Occupational hernia was proportionately more frequent among workers of southern European stock. Clark reports that operative repair cured approximately three-fourths of those so treated. Over a period of several years, recurrence took place in approximately 25 per cent. of those previously operated on.—K. R. D.

OPERATIVE TREATMENT OF HERNIA OF COAL MINERS WITH LIVING SUTURES. *E. B. Henson. West Va. Med. Jour., Jan., 1928, vol. 24, p. 32.*

A CONSIDERATION OF INJURIES TO BONE AND JOINT TISSUES, WITH SUGGESTIONS FOR MINIMIZING THE INDUSTRIAL HANDICAP. *L. Thornton. Proc. Fourteenth Ann. Meeting Internat. Assn. Indust. Accident Boards and Commissions, U. S. Bur. Labor Statistics, Bull. No. 456, Feb., 1928, pp. 82–85 (discussion pp. 85–93).*

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

HISTOPATHOLOGY OF SKIN CHANGES DUE TO ELECTRIC CURRENT. *W. Weimann. Deutsch. Ztschr. f. d. ges. gerichtl. Med., 1927, vol. 9, pp. 587–598.*

The histopathologic alterations in the skin effected by electric current are discussed in accordance with the observations on five cases. Burn phenomena are generally in the foreground: heat vesicles, either limited to the horny layer of epidermis or penetrating the deeper layer along the sweat glands; and craters, where the epidermis is completely burned. In one case hemorrhages dominated the histologic picture.—S. W.

OBSERVATIONS IN CASES OF FATAL ELECTRIC SHOCK WITH SPECIAL REFERENCE TO THE CHANGES IN THE SKIN AND HAIR. *G. Strassmann. Deutsch. Ztschr. f. d. ges. gerichtl. Med., 1927, vol. 9, pp. 699–717.*

The mechanism of the alteration of the skin by electric currents of the positive and negative poles was studied. A current of 220 volts was used on hairy and hairless parts of the skin of cadavers and on certain internal organs (particularly on the liver). A great difference was observed between the effects of the positive and negative poles. At the positive pole heat vesicles and carbonization were observed,

with brownish-black coloration of the part affected and crater formation. At the negative pole the internal organs and the skin showed small blisters, with brown coloration; carbonization and craters were not present. Singeing of the hair was rarely observed.

Studies of different organs have shown that the effect of the same current is not constant. The length of time that current marks (*Strommarke*) are visible and the artificial production of these marks are discussed.—S. W.

WOMEN AND CHILDREN IN INDUSTRY

MOTHERHOOD AND OCCUPATION. *Labeaume. Abstr. as follows from Ann. d'hyg. pub. indust. et sociale, 1927, vol. 5, pp. 517–556, in Bull. Hyg., March, 1928, vol. 3, pp. 191–192.*

Female labor is increasing in France; actually and in proportion to the population which is decreasing, largely owing to the high infantile mortality among children born to working mothers. Figures in support of these statements are given. Separation of mother and child, with absence of breast feeding, is to blame. Nevertheless, social conditions in France call for female labor, and steps are required to meet the situation. Necessitous mothers need aid and ignorant ones instructions to bring up their children; often money is less called for than information how to use available resources. Family allowances are in vogue; but factories where female labor is indispensable should give pregnant women light work, and provide rooms and opportunity for breast feeding. Better still, the example of some large establishments should be copied who allow ten to twelve months' leave at childbirth and then reengage the mother. A law is required authorizing mothers to stop work during pregnancy and to feed their children without being in any way prejudiced in resuming their work.

PROVISION FOR BREAST FEEDING FOR BABIES OF MOTHERS IN INDUSTRY. *G. Ichok. Rev. d'hyg., Jan., 1928, vol. 50, pp. 41–55.*

The author cites statistics showing the high death rate prevailing among infants deprived of natural feeding owing to the fact that the mothers have to be at work. During the war when women went into industry more generally statistics show more favorable conditions, and, according to an inquiry into over seventy nursing rooms provided for mothers in which to nurse their babies, the infant mortality rate was, in general, nil, or, at the highest, 2 per cent.

The objections to provision of nursing rooms in factories are discussed. It is claimed that cost of installation of these rooms need not be high, only the simplest furniture being necessary or advisable, the object being simply to make possible the nursing of the infants of working mothers. It is also maintained that the working mothers do not tend to be tuberculous, as believed by some medical men, and that among the babies, in spite of the long distances over which they have to be brought to the mothers' places of work, the morbidity and mortality rates are low.

A brief account of the growth in provision of nursing rooms is given, the earliest in France being initiated

in 1846, and legislation on the subject is reviewed. Approach toward better and more ideal care of the nursing mother who must work is largely dependent on education to that point of view among employers, the state, and municipalities. A bibliography of references to French writers and decrees on the subject is appended.—B. A.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

PENETRATION OF DAYLIGHT AND SUNLIGHT INTO BUILDINGS. *Dept. Scientific and Indust. Res., Illumination Res., Tech. Paper No. 7, pp. 21. H. M. Stationery Office, 1927. Abstr. as follows in Bull. Hyg., April, 1928, vol. 3, pp. 288, 290.*

This important paper deals with the following matters:

(a) *Definition of the "sill-ratio,"* which is the ratio (expressed as a percentage) of the illumination at any point in a room to the illumination (at the same time) of the window-sill of that room if exposed to unobstructed light from the sky.

(b) *Estimation of sill-ratios* by a method of plotting the window area upon squared paper representing 100 per cent. sill-illumination. Various values in area are allotted according as access of direct skylight to the window is obstructed.

(c) *Presumptive standard value of unobstructed sill-illumination.* In view of the convenience of having such a standard, so that the sill-ratio may be converted forthwith into terms of foot-candle illumination of room interiors, it is proposed to adopt as a standard the sill-illumination as averaged from actual determinations on typical dull days. This is stated to be 250 foot-candles.

In relation to that proposed standard, certain practical data are given above.

The table-height (taken as 2 ft. 9 in. above floor) is referred to as the "working plane" or "plane of reference"; no point on it which is not open at some time to unobstructed access of light from the sky can be considered adequately lit for ordinary clerical work.

(d) *Some modifying factors.* The capacity to reflect light is usually greatly over-estimated; the maximum "reflection-factor" even for glazed white brick is only 60 per cent. of the direct incident sunlight, while the average reflection-factor for room interiors with white ceilings and light walls is some 30 per cent. Under adverse conditions, whitewash loses 10 per cent. of its reflection-factor within a week, and all light-reflecting surfaces relied upon for lighting should be cleaned every quarter.

Smooth, vertical window-panes lose 50 per cent. of their capacity to transmit light if they be left uncleaned in an average town for 6 months.

THE RELATION BETWEEN VISUAL ACUITY AND ILLUMINATION. *S. Hecht. Abstr. as follows from Jour. Gen. Physiol., 1928, vol. 11, pp. 255–281, in Chem. Abstr., May 10, 1928, vol. 22, p. 1603.*

A further study of this problem which is of interest to students of the photochemistry of vision.

A PHYSIOLOGICAL INVESTIGATION OF THE RADIANT HEATING IN VARIOUS BUILDINGS. *H. M. Vernon, M. D. Vernon, and I. Lorrain-Smith. Indust. Fatigue Res. Board, Rep. No. 46, pp. 56. H. M. Stationery Office, 1928.*

In order to measure the radiant heat emitted by various heating systems, and from the walls, etc., of the rooms containing them, a Moll thermopile was used. This instrument

contains 80 manganin-constantan junctions of such extreme thinness that the galvanometer attached to the instrument attains its maximum deflection in seven seconds. The thermopile was calibrated by means of a copper vessel with a lampblack surface 1 foot square, which had a temperature ranging from 7°F. below, to 56°F. above, the air temperature. The deflections were in accordance with Stephan's fourth power law of radiation. When measuring the radiant heat in rooms, the thermopile was first turned to a black surface (*viz.*, a tin containing water) at the room temperature, and then to the walls, ceiling, and floor. As whitewashed surfaces and most painted surfaces have the same emissivity as lampblack, the approximate mean radiant temperature could be inferred directly.

A number of buildings (offices, shops, a school, and a hospital), heated by the panel system, were investigated. In this system coils of steel pipes, of half-inch internal diameter, are run in the ceiling or walls, just beneath the plaster. Hot water is circulated through them and keeps the whole surface at about 100°F. When the pipes are in the ceiling, almost the whole of the heat transmission is radiant. This radiant heat warms the walls, floor, etc., directly, and they in turn warm the air of the room. They transmit their heat so quickly that the air is only 3° cooler than the walls. The air temperature of the room is remarkably uniform, and does not differ by more than 1°F. at all levels up to within a few inches of the ceiling, where it may be 2° higher. With one slight exception, the panel radiation was not found to induce an appreciable sensation of warmth, either in the investigators or in a large number of operatives working at a shoe factory where a panel system was installed. That is to say, no support was obtained to the frequently repeated claim that in panel heated rooms a comfortable sensation of warmth is experienced at a considerably lower air temperature than in rooms heated by hot water radiators, which heat mainly by air convection. In contrast to this result, a room heated by a gas fire felt comfortably warm when the air temperature was 7°F. cooler than in convection heated rooms. The reason for this difference is that, owing to the operation of the fourth power law, the excess in the intensity of the radiation from some parts of a gas fire (which may have a temperature of 2,000°F.) over that from surrounding objects, is about 1,400 times greater than the excess of radiation from a panel heated to 100°F. It is true that in rooms warmed by a badly designed hot water radiator system, where there is a steep temperature gradient and the air temperature at head level is 5° or so higher than at foot level, a higher air temperature is needed in order to induce comfort than with a panel system; but if the radiators are low ones, and are fixed near to the floor at several places in the room (especially under the windows) so as to yield an even distribution of heat, little if any excess of air temperature is needed in order to induce comfort.

Another method of heating which gives an even distribution of air temperature is the installation of electric tubes at floor level. These tubes are heated to about 270°F., and

give off a large proportion of their heat in a radiant form.

In rooms heated by convection systems, the temperature of the walls is about 3°F. lower than the temperature of the air.—H. M. V.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

METHODS OF IMPROVING MINING CAMP SANITATION FROM STANDPOINT OF INDUSTRIAL MEDICINE. *J. G. Bentley. Virginia Med. Monthly, Jan., 1928, vol. 54, p. 638.*

EXAMINATION OF MALE YOUNG PERSONS IN THE METAL INDUSTRY. *W. Eliassow. Abstr. as follows from Zentralbl. f. Gewerbehyg., July, 1927, N. S. vol. 4, pp. 231–233, in Bull. Hyg., March, 1928, vol. 3, pp. 221–222.*

The author describes an interesting intensive study being made of the physical conditions of eighty boys between 14 and 18 employed in motor car and typewriter construction works in Frankfurt during a period of four years from April, 1926, to April, 1930. He points out the negative value of school medical examination. Here the lads will be submitted at the beginning and end of every year to the most searching physical and anthropometric measurements by means of delicate apparatus, so that it is hoped to obtain definite positive data of the effect of the particular industry on health and bodily development.

Figures are given comparing his own first data with those of Epstein made in Munich in 1913 and by Ascher in Hamm in 1913. Eliassow's figures as to height, weight, and average chest measurement are always the most favorable.

HOW THE DOCTOR CAN ASSIST IN MAKING THE RAILROAD MORE EFFICIENT AND ECONOMIC. *W. G. Harris. Texas State Jour. Med., Feb., 1928, vol. 23, pp. 681–682.*

The physician can best assist in the efficient and economic operation of a railroad not only by making an examination of the sight and hearing of employees every six months, as directed by the Interstate Railroad Commission, but also by making both physical and mental examinations of each applicant for employment. Workers who are unfit can thus be eliminated and fit workers be placed in positions they can best fill. Age should not be considered as a factor in efficiency; mental and physical characteristics should.—B. A.

THE HEALTH RECORD OF UNIVERSITY STUDENTS AS RELATED TO TONSILLECTOMY. *W. E. Forsythe. U. S. Pub. Health Rep., March 9, 1928, vol. 43, pp. 560–563.*

The improvements so frequently seen to follow well-advised tonsillectomy seem to justify the supposition that a significant difference might be demonstrated between groups of persons having, and those not having had the operation. In an attempt at studying that question, the experience of the University of Michigan Health Service has been drawn upon. For several years the department has examined entering students, cared for their subsequent illness, and collected considerable data.

In an effort at evaluation of the

tonsillectomy, the records of two classes have been analyzed. Students entering without tonsils have been compared with those entering with tonsils in place. Little if any significant difference in these data is, apparently, revealed. There is a suggestion of advantage to the tonsillectomized group in general appearance of nutrition and general health grade. The most significant differences seem to indicate that those students with their tonsils in have less trouble with acute upper respiratory infections, but they have more cervical adenopathy.—E. O.

THE VALUE OF ROUTINE FLUOROSCOPIC EXAMINATIONS OF THE CHEST AMONG INDUSTRIAL EMPLOYEES. *H. H. Fellows and W. H. Ordway. Am. Rev. Tuberc., March, 1928, vol. 17, pp. 201–203.*

Fluoroscopic examination of 800 applicants for employment in the Metropolitan Life Insurance Company accepted after history and physical examination revealed eight cases of well-developed pulmonary tuberculosis —two showing calcified lesions and six classified as potential prospects for sanatorium care.

The authors consider this method of examination rapid, economical, and accurate, and believe that a wider experience will prove of distinct value in diagnosis and will bring to light many cases which later break down with active tuberculosis.—M. C. S.

HOSPITAL SERVICE IN THE UNITED STATES. *Jour. Am. Med. Assn., March 24, 1928, vol. 90, pp. 911–979.*

In the seventh annual presentation of data on hospital service in the United States by the Council on Medical Education and Hospitals of the American Medical Association, figures are given for industrial hospitals, embracing information supplied by the hospitals themselves during the last of 1927.

Analysis of the figures according to type of service rendered shows that industrial hospitals—or those used mainly for industrial patients—have increased in number during the past five years from seventy to 168. The cause for this increase is not now apparent and furnishes a subject for further inquiry. There are no industrial hospitals in some important industrial states and only three in New York, five in Pennsylvania, and seven in Illinois, while there are twenty-three in California and sixteen in Massachusetts. It seems that the industrial cases in the strongest industrial states are cared for almost entirely in general hospitals which do not belong to the industries themselves.

According to ownership or control, analysis of the figures shows that in the field of industrially owned hospitals there has been a very healthy increase during the past five years from 146 to 161 hospitals and a corresponding increase in the number of beds and the number of patients, so that at present the industries control 7,032 beds having an average of 3,694 patients. Obviously, the low degree of occupancy is due to the nature of the problem of hospitalization in industry, particularly to the number of emergency cases and the uncertainty with which beds will be occupied. These figures relate to those hospitals which are owned outright by industrial concerns, although some of them

serve others as well as their employees.

A list of 6,807 hospitals registered by the American Medical Association is given on pages 923–979, classified by states and showing population of city in which the hospital is located, type of service rendered, ownership or control, number of beds, and average number of patients.—E. O.

INDUSTRIAL NURSING

INDUSTRIAL NURSING NOTES. *Pub. Health Nurse, Oct., 1927, vol. 19, pp. 499–502.*

Interesting accounts are given of the activities of the industrial nurses in fourteen plants in Oakland, Calif., and of the visiting nurses connected with the Practical Housekeeping Center in Calumet, Pa., which is centrally located for five mining towns. There is also an abstract of a discussion held in the Industrial Nurses' Section of the New England Division of the American Nurses' Association regarding the service of a factory clinic. The questions particularly discussed in this connection are: How far should the employer go in keeping the partially disabled employee on the job? and How get the malingerer back on the job?—M. C. S.

INDUSTRIAL INVESTIGATIONS AND SURVEYS

THE PAPER BOX INDUSTRY IN NEW YORK CITY. *N. Y. State Dept. Labor, Special Bull. No. 154, 1928, pp. 90.*

This investigation covered eighty-five shops and 1,921 workers, or roughly one-quarter of the industry. Firms of all sizes were studied, the smallest employing only two workers; the largest, 122.

Physical working conditions in many paper box factories were below standard. Workrooms were dirty and there was inexcusable neglect in regard to sanitary arrangements. Cellars were often used as cutting rooms, exposing workers to cold and dampness in the spring and fall and to excessive heat from the boilers in winter. The ventilation and lighting of the workrooms, other than the cellar cutting rooms, were found to be fairly satisfactory.

In only seven plants had special attention been given to the proper seating of workers. One firm had installed properly designed and constructed posture chairs for all its workers; the other six provided a number of these chairs but supplemented them with stools or kitchen chairs. No attempt had been made to arrange the work so that operatives could either sit or stand at the job.

None of the firms provided a lunch room for their employees but several had facilities for preparing a hot drink and one served tea and coffee without charge. Only one had a separate rest room, all the others using the coat room for this purpose.

The number of hours which workers are scheduled to work is comparatively short. About one-third of the workers were on a forty-six-hour week; another third had hours beyond this but less than forty-eight; while the remaining third had hours of forty-eight or over.

From the accident standpoint, the paper box industry is decidedly less

hazardous than the most dangerous factory work, but exceeds a number of large and important industries—clothing, knit goods, cotton spinning and weaving, boot and shoe, and printing—in the amount of risk to which its operatives are exposed. In the four years, 1923 to 1926, inclusive, for which accident figures are shown, and in the three years, 1924 to 1926, inclusive, for which compensation cost is given, both the relative number and the cost of permanent partial injuries were higher than for all industries.—M. C. S.

UNION SCALE OF WAGES AND HOURS OF LABOR, 1926. *W. J. Maguire. Pa. Dept. Labor and Industry, Special Bull. No. 20, 1927, pp. 88.*

UNION SCALES OF WAGES AND HOURS OF LABOR, MAY 15, 1927. *U. S. Bur. Labor Statistics, Bull. No. 457, March, 1928, pp. 233.*

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

AN EXPERIMENTAL INVESTIGATION INTO TRANSFER OF TRAINING IN SKILLED PERFORMANCES. *J. N. Langdon and E. M. Yates. Brit. Jour. Psychol., 1928, vol. 18, pp. 422–437.*

The object of the investigation was to ascertain whether manual dexterity acquired in one occupation was transferred in any degree to the performance of other occupations. A group of thirty-two boys, aged 15 to 18, were subjected to two weeks' training in the occupation of putting driving chain links on to spindles. During this practice period they improved over 50 per cent. in speed. Before the training began, at the end of the first week, and at the end of the fortnight, the trainees performed a number of tests such as match insertion, placing rings on a rod, threading links, steadiness tests, etc., while another group of twenty-eight untrained boys of the same ages acted as a control, and performed the same tests. The motivation was the same in both groups, as the boys were paid a minimum wage together with a considerable bonus depending on the degree of improvement effected. A comparison between the two groups with regard to improvement in the performance of the tests on the third occasion as compared with the first occasion in no case showed a difference of such a size as to exclude the possibility of its being due to chance factors. Hence it is concluded that the effect of the training was specific, and not general.—H. M. V.

THE NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY. ANNUAL REPORT FOR THE YEAR 1927. *1928, pp. 24; Jour. Nat. Inst. Indust. Psychol., April, 1928, vol. 4, pp. 59–85.*

This annual report tells again of increased activities of the Institute. Applications are being received for advice on the organization and layout of factories, as well as for investigations into methods of work and the environment of labor. Increasing use is being made of vocational guidance by firms and by private individuals. Instances are quoted of work done at gas and chemical works, in the textile industry

and departmental stores, in making screws and building motor cars, at handling railway goods, and in many other occupations too numerous for mention. A special section recounts the research work in progress regarding such things as vocational guidance, women's work, and ultraviolet rays. At the same time the interest of the public is being aroused by lectures, demonstrations, and conferences. The report is a clear indication of new thoughts and methods permeating industrial life.—E. L. C.

A Psychiatric Guide for Employment. *V. V. Anderson. Personnel Jour., April, 1928, vol. 6, pp. 417–441.*

An employment procedure is suggested "that is fundamentally clinical in nature and that seeks through an application of medical, psychological, psychiatric, and social technique, to discover and evaluate the essential factors underlying the individual's life adjustments, to prognose his work potentialities, and to improve his ways of meeting job and other life situations."—M. C. S.

How They Test Workers in Germany. *A. F. Payne. Indust. Psychol., Feb., 1928, vol. 3, pp. 68–73.*

The author considers that in the United States, in the application of the principles of scientific management to the workers, we seem to have specialized on the social phases of the problem—welfare work, industrial relations, and employee representation—and to have neglected, in application at least, the scientific phase—selection, placement, and adjustment of the worker—which has been so well developed in Germany. There is very close co-operation between the industries and the universities and technical schools in Germany. The technical high schools, of which there are some ten or twelve, have well-organized departments of psychotechnic which are specializing in developing and standardizing devices for measuring the wide variety of elements that concern men and jobs. Their most obvious function is that of training young men in the technic of measurement in the field of psychology, particularly as applied to the technical phases of industry, and in applying this technic to the solution of industrial problems.

German psychologists use very few paper and pencil tests; they employ chiefly mechanical appliances, several of which the author describes, with illustrations: appliances for testing acuity of vision, technical intelligence, control of strength, and devices for measuring hand tremor and capacity to judge distances. "Germany has apparently learned the lesson that our industrial managers have still to learn, that is, to handle the workers as carefully and scientifically as they do material and money."—M. C. S.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

Miners' Welfare Fund. Sixth Annual Report for the Year 1927. *H. M. Stationery Office, 1928, pp. 91.*

This report deals with the first year of the second period of five years extended by Parliament to the Fund which is formed by a levy of 1 penny on each ton of coal raised. This sum

which amounts normally to about £1,000,000 annually has now been supplemented by a further sum of £250,000 a year, with, however, the onus of providing pithead baths.

The present report, like its predecessors, tells of activities financed with regard to recreation grounds and playing fields, open air baths, institutes, and convalescent homes, and buildings and equipment for education, but is distinctive in several particulars. It tells of the first year's working of a miners' scholarship scheme, founded from the central Fund, under which ten men and the daughter of a miner were awarded university scholarships in 1927; this educational scheme is full of interest. Progress is also reported with regard to pithead baths which are as yet in the experimental stage; every effort is being made, based on information from abroad and at home, to combine efficiency with economy before an extensive constructional program is launched. Mention is also made of new ventures in providing drinking water taps at pitheads, and small pithead canteens of which plans are given. Like its forerunners, the report is well illustrated and printed.—E. L. C.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

STATE LAWS AFFECTING WORKING WOMEN. HOURS, MINIMUM WAGE, HOME WORK. *U. S. Dept. Labor, Women's Bur., Bull. No. 63, 1927, pp. 51.*

IDIOSYNCRASY AND ANAPHYLAXIS AS RELATED TO COMPENSATION. *A. Mori. Abstr. as follows from Arch. di antropol. crim., Sept.-Oct., 1927, vol. 47, p. 630, in Jour. Am. Med. Assn., April 7, 1928, vol. 90, p. 1166.*

A differentiation between anaphylaxis and idiosyncrasy is attempted in the following definitions. Anaphylaxis has its origin in a protein or colloid substance; it gives rise to specific reactions. It has an affinity for preformed antibodies and their respective antigens. It requires a period of incubation for the preparation of sensitiveness. It displays the anergic phenomenon of Pirquet, and is capable of passive transmission from supposedly sensitized to immune individuals. Idiosyncrasy is a property deriving its characteristics from a protein, but likewise from a crystalloid substance, without regard to antigens. It is not preceded by a period of incubation. It possesses an hereditary character suggesting functional stigmas of a nervous or dyscrasic kind. It lacks a period of anergy and a demonstrable passive transmissibility. However, Mori admits that the differentiation is not at all clear cut. It is sufficient to state that certain individuals present phenomena of morbid hypersensitiveness to certain chemical, vegetable, or animal substances, or to parasites; further, that there is a possibility of preparing artificial antigens, and that recent researches in anaphylaxis originated in the study of hay fever. An extensive historical review of the subject is presented. Experimental anaphylaxis expresses itself in mucocutaneous, respiratory, circulatory, and hematologic manifestations, as well as in serologic changes, such as disappearance or rapid diminution of

the complement and of precipitins. He adds personal observations of two laborers unaccustomed to field work, of previous good health, who, while handling hay, developed on the same date and at almost the same hour edema of the face, intense conjunctival hyperemia, and coryza. In one case there was a small ulceration on the mucous membrane of the right nostril. In the second case a fissure in the nasal mucosa was noted. These two cases present typical anaphylactic phenomena due to the pollen of hay. In a third case, erythema of the face with intense conjunctivitis and coryza developed in a tin worker while carting dried reeds. He finds no answer in the literature to the question of liability in such cases, but concludes that they should be covered by compensation, even though they are the consequence of a certain morbid intolerance.—K. R. D.

MEDICO-LEGAL ASPECTS OF OCCUPATIONAL DISEASE. *H. H. Kessler and B. S. Coleman. Am. Jour. Pub. Health, March, 1928, vol. 18, pp. 269–281.*

The authors of this paper state that "An experience with the management and adjudication of cases of occupational diseases leads us to the belief that only occupational poisons should be compensated; that all other forms of illness which can directly or indirectly be traced to industrial conditions should be compensated through a system of workmen's sickness insurance; that increased reporting of occupational disease could be accomplished from a three-point attack: compulsory reporting of the doctor to the board of health, compulsory reporting to the department of labor by the employer, and the establishment of an occupational disease clinic, under state auspices, for the dissemination of information and the demonstration of methods of examination and detection of occupational disease." It is the authors' belief that three times as many claims for occupational disease have been filed since its inclusion in compensation laws as were filed before, but that this increase falls far short of revealing the real situation.

Upon the medical adviser rests the responsibility for the arbitration of awards of compensation for occupational disease, for the referee and commissioner look to him for a correct and intelligent solution of the problems to be met. These problems are presented as being fivefold; the medical examiner as arbitrator must:

1. Make a diagnosis
2. Determine the responsibility for the occupational disease if it exists
3. Decide the temporary period of disability
4. Determine the permanent disability
5. Determine the cause of death

The use of the strength diminution, as determined by the Martin test, and reduction of life expectancy are suggested as providing a uniform basic principle, not necessarily arbitrary, by which disability could be determined. Autopsy is considered the most important factor in determining the cause of death.

A list of twenty-nine references is appended, and a valuable discussion is added in which industrial physicians from several states give their views and experience.—B. A.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

SICKNESS AMONG PERSONS IN DIFFERENT OCCUPATIONS OF A PUBLIC UTILITY. *D. K. Brundage. U. S. Pub. Health Rep., Feb. 10, 1928, vol. 43, pp. 314–335.*

This study was made among the employees of the Edison Electric Illuminating Company of Boston, during the years 1922 to 1924, inclusive. About 80 per cent. of the sicknesses lasting two days or longer (excluding accidents) were seen by a physician.

Brundage found that the frequency of absence for one day or longer on account of sickness decreased gradually with the age of the employee among males and declined sharply between the ages of 30 and 50 among females. Among the men sicknesses of from one to three days' duration decreased sharply with the age of the employee, those of four to seven days' duration remained constant for all ages, and those of eight days' and greater duration increased with advancing age. About the same relations existed among the females. Sicknesses of all durations in both sexes decreased with the duration of service of the employee, even when the age of the employee was held constant.

It was found that repair men, linemen, and oilers showed an excessive number of sicknesses (digestive, respiratory, and rheumatism) when due allowances were made for certain disturbing factors. Repair men, oilmen, oilers, and a few others of five or more years' service with the Company, had higher morbidity rates than the similarly occupied employees of five years' and less service.

The correlation between industrial and nonindustrial accidents for twenty-four occupations was 0.43 ± 0.11 showing the probable existence of a personal factor in accidents independent of the hazard.—C. R. D.

IMPORTANCE OF RESPIRATORY DISEASES AS A CAUSE OF DISABILITY AMONG INDUSTRIAL WORKERS. *D. K. Brundage. U. S. Pub. Health Rep., March 16, 1928, vol. 43, pp. 603–610.*

Analysis of a ten-year record of disabling illness among the employees of the Edison Electric Illuminating Company of Boston showed that 54 per cent. of all the absences on account of sickness among the men were caused by diseases of the respiratory tract. As a cause of absence from work among employees of this Company, no other disease group approached in importance the respiratory diseases.

The sickness records of the Company showed an annual loss of 3.23 calendar days of disability from respiratory diseases per male employee, compared with 6.92 days of disability from all causes of sickness per man on the payroll, or approximately 47 per cent. of the time lost. The common cold was by far the worst offender as a cause of disabilities of one day or longer among male employees; diseases of the pharynx and tonsils occupied second place; influenza and grip, third place; and bronchitis, fourth. When only the eight-day and longer illnesses are considered, the common cold, which caused 71 per cent. of the absences for one day or over from diseases of the respiratory system, drops out of the picture, influenza and grip

occupying first place, diseases of the pharynx and tonsils second place, bronchitis third, and pneumonia (all forms) fourth.

The records for disabilities of one day or longer and of eight days or longer both showed the minimum respiratory incidence rate in the month of July and the maximum rate in February. Respiratory disabilities lasting longer than one week occurred oftener in March than in January and more frequently in April than in December. In contrast, the record for disabilities of one day or longer indicated practically the same respiratory rate in March as in January, and a lower rate in April than in December. Attacks of respiratory sickness having their onset in the late winter and early spring evidently tend to be more prolonged than those which begin in the early part of the winter. From this it appears that industrial workers possess less resistance to respiratory infections toward the end of the winter than at its beginning.

The frequency of disability lasting eight days or longer on account of diseases of the respiratory system varied greatly among the twenty-six industrial sick benefit associations which reported their claims to the United States Public Health Service throughout the three years ending Dec. 31, 1926. Wide differences in death rates as well as in rates of sickness from the respiratory diseases as a whole and from specific diseases of the respiratory system are found in different states, cities, and communities. The causes of these wide differences should be investigated and thoroughly understood before any measure of success can be expected in the prevention or control of these diseases among industrial groups.

The United States Public Health Service is at present assembling records of cases of lobar pneumonia and the conditions under which they occur in certain groups of industrial workers known to have a high rate and in other groups experiencing average or less than average frequency. Analysis of these records, it is believed, will throw some light on the influence of some of the more important causes of high sickness and death rates from the disease.—M. C. S.

ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

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HEAT, COLD, AND HUMIDITY

THE PHYSIOLOGICAL EFFECT OF EXTERNAL HEAT UPON THE HUMAN BODY. *R. Pemberton. Ann. Clin. Med., Feb., 1927, vol. 5, pp. 763–771.*

This is a brief review of the biochemical effects of external heat upon the human body. Sweat, blood concentration and circulation, respiration, and metabolism are discussed and suggestions are made as to the therapeutic as well as the deleterious effects of external heat.—C. P. Y.

THE EFFECTS OF HIGH TEMPERATURE ON THE HEART AND CIRCULATION IN INTACT ANIMALS. *S. N. Cheer. Abstr. as follows from Am. Jour. Physiol., 1928, vol. 84, pp. 587–598, in Physiol. Abstr., Aug., 1928, vol. 13, p. 296.*

The animal anesthetized was first cooled and then gradually warmed till death ensued. The changes observed were divided into four stages: I. Recovery from previous cooling, II. from body temperature to the temperature where cardiac irregularities first appear, III. the precritical stage up to where the cardiac irregularities became critical, IV. the final stage ending in death. In stage I. the outstanding point is the extreme lengthening of systole. This gradually passes off with rise of temperature. In stage II. the respiration rate and pulse increase and systole diminishes. Small changes occur in the electrocardiogram. In stage III. alveolar and blood carbon dioxide decrease and a mild alkalosis supervenes. The heart accelerates, A. V. tone falls, systolic and diastolic pressures decline. Systole and systolic ejection become markedly reduced. Alternation may appear transitorily. In stage IV. marked irregularity of the heart sets in. The S. A. node remains the pacemaker to the end, but A. V.

block and ventricular arhythmia of different types supervene. The duration of systole shows a sudden increase as the heart fails. The cessation of the circulation depends on the heart, and is independent of the respiration.—C. K. D.

THE INFLUENCE OF THE AMOUNT OF WATER DRUNK ON THE CHLORINE CONTENT OF THE SWEAT AND BLOOD OF MEN IN HIGH TEMPERATURE. *M. Marschak and L. Klaus. Gigiena Truda, 1927, no. 9, pp. 14–22.*

Three series of experiments (seventy-two experiments in all) were carried out on six persons under the same air conditions: 46°C. dry bulb and 50 per cent. relative humidity (corresponding to a wet kata cooling power of 2 millicalories per square centimeter per second or 36° effective temperature). In the first series the subjects drank no water; in the second series the subjects drank 2 liters of tap water; and in the third series the subjects drank 2 liters of 1 per cent. saline solution. The experiments in the first series lasted two hours; those in the second and third series, three hours. The sweat and blood tests were taken 40, 80, 120, 150, and 180 minutes after the subjects entered the experimental chamber (blood tests were also made before the subjects entered the chamber).

The authors' findings show: (1) an increase in the chlorine concentration in the sweat depending on the duration of sweating; (2) decrease in percentage of chlorine in whole blood and in serum, which is ascribed to a disturbance in the exchange of water-mineral solutions; (3) water drunk during sweating produces a greater excretion of water and minerals; (4) by drinking 1 per cent. saline solution these disturbances are compensated.—M. C. S.

EFFECTS ON THE PHYSICAL CONDITION OF THE BLOOD IN HIGH TEMPERATURE PRODUCED BY DRINKING WATER AND SALINE SOLUTION. *M. Marschak and O. Dukelskaja. Gigiena Truda, 1928, no. 1, pp. 29–38.*

The authors made experiments on normal subjects in an experimental chamber at a temperature of from 40° to 46°C. and a relative humidity of 30 to 50 per cent. In one series the subjects were at rest and in the other the subjects were engaged in physical work.

1. Thirty to sixty minutes after the subjects entered the room a thinning of the blood occurred, followed by an increasing thickening of the blood as the experiment progressed. Most of the subjects could not remain in the chamber more than two hours. Drinking water had almost no effect on the physical condition of the blood; the subjects felt more comfortable, however, and were able to remain in the chamber as long as three hours. Introduction of saline solution caused a thinning of the blood which lasted during the three hours of the experiment. The comfort of the subjects was markedly increased.

2. In physical work under the same conditions there occurred early a decided thickening of the blood which was little affected by drinking water but which disappeared entirely or almost entirely when salt was introduced into the system. By varying the amount of work and the temperature conditions, the authors noted that

the resulting blood changes were not dependent on the duration of work but on the secretion of perspiration.

3. The body temperature rose steadily throughout the experiment under the conditions of high temperature both during rest and during work. Drinking water and especially saline solution lessened the rise in temperature.—M. C. S.

CONDITIONS OF WORK IN THE TULA SUGAR REFINERY, AND THEIR INFLUENCE ON THE WORKERS' ORGANISM. *B. Schafranov. Gigiena Truda, 1927, no. 5, pp. 7–15.*

From January to April, 1925, the author investigated the influence of high air temperatures on the organism of men employed in the following workrooms of this sugar refinery: drying room fitted with apparatus of the Passburg system, filling chamber, corridor connecting the pulverizing room with the filling chamber, and the light drying room. The corresponding average temperatures and relative humidities for these workrooms were 45.2°C. and 17 per cent., 42.4°C. and 27 per cent., 37°C. and 32 per cent., and 42.7°C. and 24 per cent., respectively.

The thermal effect of the air of the rooms was studied with the katathermometer and the following data obtained: In the Passburg drying room, dry kata was 4.3 (on the third floor) and 4.8 (on the fourth); wet kata, 9.3 and 9.2 millicalories. In the light drying room, dry kata was 4 (fourth floor), 2.8 (third), and 1.2 (second floor); wet kata was 7.7, 7.1, and 10. In the corridor mentioned above, dry kata was inert; wet kata showed a cooling power of 8 millicalories. In the pulverizing room the dry and the wet kata were, respectively, 3.1 and 10.9 millicalories.

In order to determine the heat loss through evaporation under these conditions, a study of the water exchange was made. This showed that, in spite of a shorter working day and shorter working period, the workers in the Passburg drying room, who had intervals of rest in a room at lower temperature, lost on an average 11.5 pounds through evaporation; while the women workers in the filling chamber, who had a longer workday, lost only 6.5 pounds. The same workers in the Passburg drying room showed, after the work periods, the greatest increase in temperature and in pulse rate.—B. A.

REVIEW OF LITERATURE ON THE PHYSIOLOGICAL EFFECTS OF ABNORMAL TEMPERATURES AND HUMIDITIES. *R. R. Sayers and S. J. Davenport. U. S. Pub. Health Rep., April 8, 1927, vol. 42, pp. 933–996.*

1. Temperature and humidity, according to the literature, are the two most important atmospheric conditions that affect the health and efficiency of people in their living and working places.

2. The belief that the ill effects experienced from exposure to crowded conditions in inclosed spaces were generally due to gaseous constituents of the air has been proved false by experiments conducted by numerous investigators. It then was thought that perhaps there were organic poisonous substances exhaled by people; this also has been proved by experimentation to be erroneous and the part played by high temperature and humidity was finally recognized.

3. Abnormal temperatures and humidities are encountered through seasonal changes in the Temperate Zones and with changing elevations in tropical climates. The large degree of conformity in the mortality curve of the cities and States throughout the world during different

periods of time seem clearly to prove that there is some definite relation of weather to disease. The effects of high temperatures encountered in seasonal variation in the Temperate Zones are considered acute, many sudden deaths occurring during certain periods of excessively hot weather, while the effects of exposure to a tropical climate are more chronic.

4. The literature in regard to the action of cold on animals is very meager. Extreme cold seems to be borne better by the human organism than extreme heat; this is partly due to the fact that the effects of cold can be mitigated by artificial control. Explorers in Antarctic regions found that in still weather no temperature was low enough to prevent outdoor work but that it was impossible to exist outside for any length of time at very low temperatures when the wind was blowing.

5. In regard to the relation of sex and age to susceptibility to abnormal atmospheric conditions, women appear to react more readily than men, and children and old persons are more easily affected. Men between 30 and 40 are said to be best adapted to endure the rigors of Arctic exploration.

6. A few of the large number of occupations which require exposure to extreme heat, humidity, and variations in temperature are listed.

7. The source or cause of animal heat was an unsolved mystery to the ancients. They had no thermometers and their knowledge of the constant heat of the human body was imperfect. A scientific attitude toward the subject was developed through contributions from time to time of knowledge obtained by various investigators, who finally determined that animal heat is the result of processes of combustion within the body.

8. It has been determined by observation that there is a limit to the heat-regulating power of the body and that an animal can not live indefinitely in a temperature higher than that of its body; according to Bernard, the larger the mass of the animal the quicker the death. Remaining at rest in saturated air at 91½°F. for one hour with no air movement caused an increase in body temperature.

9. The effects on the human body of abnormal air temperatures are modified by humidity, air motion, exercise, physical condition of persons exposed, food eaten, clothing worn, and individual idiosyncrasy.

(*a*) Humidity increases the discomfort and ill effects of both high and low temperature. Comfort, as determined by both sense and physiological reactions, depends solely upon effective temperature. At 32° the effective-temperature line coincides with the dry-bulb temperature line; hence, in this particular case, dry-bulb temperature is the only factor in determining comfort. In the comfort zone, comfort depends equally upon wet-bulb and dry-bulb temperatures. At about 132° the effective temperature coincides with the wet-bulb temperature, and for this case the wet-bulb temperature is the only factor. Below 32° the effect of humidity is reversed—that is, the lower the humidity the greater the feeling of warmth.

(*b*) The limiting physiological reaction caused by high temperatures, as determined by comfort, is not body temperature but the pulse rate. When this is above 135 the first symptoms of discomfort arise; when above 160 the effects are severe to distressing.

(*c*) Air movement decreases the discomfort of high temperatures below 98°F.; moving saturated air above 98°F. was found to be of no benefit and, apparently, is even disadvantageous. A thermometric chart is given showing effective temperatures for different air velocities at different temperatures and humidities, as well as for still air conditions.

(*d*) The upper limit in atmospheric conditions at which work can be performed efficiently corresponds to a dry-bulb temperature of 100° and a relative humidity of 30 per cent, or 90° or 95°F. in still saturated air, even when stripped to the waist. The optimum temperature at rest is around 66°F.; and with hard work the optimum temperature is 59.5°; 43°F. was pronounced as too cold with or without air movement, regardless of humidity. In still air no temperature is too low to prevent outdoor work.

(*e*) Normal clothing at ordinary humidity was found to halve the cooling effect

of wind as compared with that obtained with the subject stripped to the waist. On the other hand, clothing under certain conditions is advantageous in increasing loss of heat by evaporation and decreasing heat gain by radiation and convection; in fact, man is capable of increasing evaporation materially by suitable clothing. At rest in still air with a temperature of 65° to 70° and with 100 per cent relative humidity, subjects stripped to the waist felt from "slightly cool" to "comfortable;" under these same conditions with moderately hard work, they felt "comfortable." At rest in still air with temperatures from 55° to 60°, 100 per cent relative humidity, clothing was required for comfort, while at moderately hard work under these conditions the subjects were "comfortable" to "cool" stripped to the waist, and at 45° to 50° subjects working moderately hard felt "cool" stripped to the waist.

10. Death generally takes place when the body temperature is raised to between 109° and 113°F., although no direct statement was found in the literature as to the air conditions and the length of exposure required to raise the body temperature to the fatal point. The lowest body temperature compatible with life is said to be 78.8°F., although Lefèvre found that a rabbit died when the temperature of the rectum had fallen to between 60° and 65°F.

11. According to one observer, the minimum accident frequency in factory work in both men and women was at 65° and 69°F. At lower air temperatures it gradually increased to a similar extent in men and women till at 50° to 54° it was 35 per cent greater than at 65° to 69°. At temperatures below 49° the frequency fell off slightly. This fall may have been due to the workers being too cold to keep up their usual rate of production. In such a case they would expose themselves to less risk of accident. At temperatures above 65° to 69° the accident frequency showed only a slight rise in the women, but in the men it increased rapidly, and at temperatures above 75° it was 39 per cent greater than at 65° to 69°. Probably this difference was due to the fact that the work of the men was often of a heavier character than that of the women, and the greater the exertion required, the more trying must be the effect of exposure to high temperatures. During the 16 months preceding the installation of the cooling plant in the Morro Velho mine there were 20 fatal accidents, while during the 16 months' period following the installation there were only 6 fatal accidents.

12. It has been found that a moderate increase of temperature—within physiological limits—augments the action of drugs and toxic substances such as carbon monoxide, mustard gas, and lead.

13. A list of the symptoms—subjective and objective—observed by different investigators is given. The most commonly observed subjective symptoms were cramp, headache, pain in the back, dizziness, great thirst, chilliness although the body temperature might be high, diarrhea, restlessness, and insomnia. Chronic exposure to excessive heat results in lowered physical efficiency and diminished resistance to fatigue and disease. The principal objective symptoms noted were changes in body temperature, pulse rate, and blood pressure, increased respiration and body metabolism, and loss of weight. The statement is made by one group of investigators that the pulse rate is probably the best single physiological measure of discomfort due to high temperature.

14. The action of high temperatures on muscular tissue is discussed, especially as a cause of fatigue.

15. The effect of cold on the body temperature up to the point of freezing is given as described in Lefèvre's "law of refrigeration."

16. Measures for the prevention of ill effects of exposure to high temperatures are given under personal hygiene and ventilation and refrigeration of working and living places. The economic value of the proper ventilation and cooling of working places is discussed.

REPORT ON ARTIFICIAL HUMIDITY IN COTTON CLOTH FACTORIES, WITH APPENDICES. *H. M. Stationery Office, 1928, pp. 88.*

This report of a departmental committee after three and a half years of

work is of unusual interest, for it goes far to lay the ghost of a controversy which has troubled the cotton industry for over fifty years. The history is traced of the claim that artificial humidity introduced into weaving sheds seriously injures the health of the operatives. Inquiries and investigations are told of, and also Cotton Cloth Factories Acts passed in 1889, 1897, and 1911. Then followed further investigations leading to the setting up of the present committee in 1924. Steps were taken to obtain accurate information regarding sickness experienced by weavers employed in sheds humidified either by steam jets or by atomized water, and in sheds not humidified. But in all the sheds thermometer readings were continuously taken. The results carefully analyzed by A. B. Hill disclosed no difference in the amount or causes of lost time due to sickness whether the weavers worked in humidified or in "dry" sheds, or whether the weavers were grouped according to the absolute atmospheric conditions prevailing. The latter grouping was needed owing to the fact that many so-called "dry" sheds were found to be as humid as the humidified sheds. These findings were certainly contrary to expectation.

Meanwhile research had been started into possible improvements in methods of sizing the warp threads; much valuable information was so acquired by F. T. Peirce, which is given fully in an appendix, on the effect of humidity and temperature on sized cotton yarn. It appears that humidity is of rather more importance to good weaving than is temperature. When the weaver is considered, temperatures over 70°F. are of rather more importance to efficiency and fatigue than is humidity. Air movement induced by revolving fans acting locally is found to reduce discomfort by increasing cooling, without having any material effect on the yarn threads. The best means to use for this purpose have not yet been determined.

After setting forth clearly the direct bearing upon industrial practice of modern knowledge regarding physiologic response to atmospheric conditions, the committee concludes that a range of temperatures and humidities exists within which the conditions are most favorable both for the worker's efficiency and for the weaving of cloth, and bases its recommendations accordingly. The legal distinction between "humid" and "dry" sheds is to be abolished; and artificial humidification is to cease when the temperature reaches 72.5°F. wet bulb, instead of 75°F. as heretofore. Further, when the wet bulb reading exceeds 80°F., all work shall cease and the operatives shall leave the premises until the temperature is reduced. The number of sheds likely to be concerned with the last named restriction will probably be small. Much of the recent scientific knowledge quoted has appeared in THIS JOURNAL to which reference is freely made. Considerable satisfaction may be expressed that practice in so important and extensive an industry as the cotton trade of Lancashire is to be based upon the sure foundation of physiologic efficiency.—E. L. C.

EFFECT OF HUMIDITY UPON THE EFFICIENCY OF TEXTILE OPERATIVES. *A. W. Thompson. Textile Recorder, 1927, vol. 45, no. 534, pp. 52, 84–85.*

TEMPERATURE AND HUMIDITY IN THE TEXTILE INDUSTRY. *S. Wyatt. Ibid., no. 536, p. 44.*

ENGLISH AND AMERICAN INVESTIGATIONS ON TEMPERATURE AND HUMIDITY AND THEIR INFLUENCE ON MEN, WITH ESPECIAL CONSIDERATION OF INDUSTRIAL AND MINE WORK. *L. Teleky. Ergebn. d. Hyg., Bakteriol., Immunitätsforsch. und exper. Therap., vol. 9, pp. 295–342. Berlin, Julius Springer, 1928.*

In the first part of this work, the author speaks of the difficulty in finding a fit measure for the wholesomeness of the atmosphere in enclosed spaces. He deduces that not only temperature and air movement, but also humidity, are important in their influence on health.

A special chapter is devoted to the kata-thermometer. Teleky finds that measurements by this instrument show a good correlation with the human sensations of comfort and that, although the kata-thermometer does not give an exact picture of the effect of atmospheric conditions on man, it is very useful in practical work. He then discusses "effective temperature"—a single measure of the effect of all three elements, temperature, humidity, and air movement—on sensations of comfort. He has converted the original effective temperature graphs and tables into centigrade units and air velocities from feet per minute to meters per second.

In the second part Teleky refers to physiologic studies in laboratories and in industries which show clearly the effects of adverse air conditions on the human body. He mentions the increase of atrophic rhinitis noted by the New York State Commission on Ventilation among workmen exposed to high temperatures and humidities and its tendency to predispose them to respiratory disease. Rabbits subjected to such conditions showed delay in formation of hemolysins and a lessened power of agglutinin formation. No marked influence on the human nervous system was observed by Baetjer. Other workers, however, have found marked physiologic effects, such as changes in pulse rate, blood pressure, and body temperature; loss in body weight by perspiration; and general discomfort. These data show a close correlation with the effective temperature index.

The author also discusses the results of research on the influence of high temperatures and humidities on metabolism, morbidity and mortality statistics, and the accident rate, referring to the special conditions found in different industrial establishments, such as iron and steel mills, silk, linen, and cotton mills, potteries, laundries, and shoe and glass factories. A special chapter is devoted to the influence of high temperature and humidity on the health and production of workers in mines. Mention is made of the increased calorific requirements of workers in hot places, their predilection for salted food, and, in case of salt deficiency, the cramps which result among workers who are exposed to extreme conditions.

The author concludes with a discussion of acclimatization to high temperatures.—W. K.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

THE COMPARATIVE VALUES OF AIR TREATMENT AS APPLIED TO VENTILATION. *W. H. Dupen. Abstr. as follows from Domestic Engin., 1928, vol. 48, pp. 3–7, 21–24, in Bull. Hyg., Aug., 1928, vol. 3, pp. 668–669.*

This long article comprises some excellent physiology quoted at length from Leonard Hill; some speculative physiology by the author and much that is familiar *re* engineering. Only the following points seem to call for note:

(*a*) Mention is made of successful collection of flue dust at flue tops [presumably by the air filters, (*c*) *infra*], as an alternative to the method of lengthening chimneys and reducing their bore at the top so as to project smoke far into the upper air strata and thus facilitate diffusion.

(*b*) It is suggested that spacious roof chambers might be used as dust settling chambers, and thus save more frequent cleaning of dust filters.

(*c*) Removal of dust from air is said to be best achieved by washing the air in a fine water spray and then passing it through a shallow box (in which it is preferably subjected to a change of direction) containing a grid of expanded metal coated with oil to make a viscous filter to which the dust adheres.

The water from the spray may be used repeatedly, the solids which it carries down being run off as sludge from the bottom of the tank. The viscous filter is cleaned by washing in hot soda solution, after which it is re-dipped in oil; if made in separate cells, these can be cleaned serially without interrupting the whole process, and this means is recommended when a large volume of air must be dealt with in a small space.

THE KATA-THERMOMETER AT SEA IN THE TROPICS. *S. F. Dudley. Abstr. as follows from Jour. Roy. Navy Med. Service, 1928, vol. 14, pp. 77–103, in Bull. Hyg., Aug., 1928, vol. 3, p. 671.*

After an account of relevant physics, the author records very extensive readings of dry and wet bulb thermometers and dry and wet kata-thermometers on a voyage from the Pacific to Sheerness *via* the Panama Canal.

While these records and the resultant conclusions will be of great interest from the naval hygienist's standpoint, the chief points of interest otherwise may be thus epitomized:

1. At dry bulb 81°F. and wet bulb 77°F., with relative humidity 76 per cent., the stokers' mess deck after all night occupation by sixty men at 100 cubic feet per man was found in the morning to have its dry bulb temperature only 3° and its wet bulb only 4° higher than those of the open deck, owing to the air changes having been maintained at a rate of twenty per hour. The 10.5 wet kata reading was correlated with comfort for the men and lack of unpleasant odor to the inspecting medical officer. Some 2,000 cubic feet of fresh air per man per hour were delivered.

2. The use of an electric fan made more difference to comfort than extra air inlet; its effect upon heat loss was in the ratio of 50 per cent. increase

to only 20 per cent. increase when a 3-inch pipe was made to deliver air into a small cabin. Hence the author suggests that power available aboard ship might be better devoted to circulating air than to introducing large amounts of fresh air, with a minimum of 50 cubic feet of fresh air per head per hour as the least amount to keep carbon dioxide below the deleterious level of 2 per cent.

3. In the switch room, acclimatized operators easily endured a wet kata cooling figure of 4 or even 3 for a quarter of the twenty-four-hour cycle.

TESTS OF ATMOSPHERES IN CHESAPEAKE AND OHIO RAILROAD TUNNELS BETWEEN CLIFTON FORGE, VIRGINIA, AND HINTON, WEST VIRGINIA. *R. R. Sayers, L. B. Berger, and W. P. Yant. U. S. Bur. Mines, Rep. Investigations, Serial No. 2858, Feb., 1928, pp. 19.*

"At the request of the Chesapeake & Ohio Railroad Co. a number of tests were made to determine the temperature, humidity, and composition of the atmosphere in certain tunnels of that railroad between Clifton Forge, Va., and Hinton, W. Va. The purpose of these tests was to determine conditions in the cabs of freight locomotives while pulling trains through these tunnels.

"Tests were made of two types of locomotives, classified by the railroad company as the H-6 and H-7. . . ."

In general, for these tests, the trains were brought to a standstill before entering the tunnel, in order that data might be obtained for the severest conditions.

"Temperature measurements were taken in the tunnels with a wet and dry bulb thermometer of the sling type, and samples of the atmosphere were obtained for determination of the carbon monoxide, sulphur dioxide, carbon dioxide, and oxygen. These temperature measurements and gas samples were taken in the engine cab near the engine man or fireman."

"Of all the tests only two showed any appreciable amount of carbon monoxide, and this in amounts that would have no dangerous effects unless exposure was for 45 minutes or longer. There was no health hazard from sulphur dioxide, carbon dioxide, or depletion of oxygen content of the atmosphere for the time of exposure in these tests. There would be danger from the gases found only if a train was stopped while in a tunnel."

High temperatures and humidities were chiefly responsible for the discomfort caused; effective temperatures of more than 100°F. were the rule and, in six of the tests, an effective temperature of 123° was registered. Exposure to temperatures of this order is endurable for short periods of ten to fifteen minutes only.

"In one test the temperature was high enough to cause a surface burn. A similar test, with the engine worked under a lighter throttle, gave conditions that caused no marked discomfort, showing the relation that train manipulation bears to the conditions in the tunnels."

Incidental tests on passenger trains in the same tunnels were negative, both with regard to excessive temperature and humidity and with regard to carbon monoxide content of the atmosphere.—M. G. P.

ON THE INDEX OF COMFORT IN THE VENTILATION OF THEATRES IN SYDNEY, NEW SOUTH WALES. *C. Badham, C. F. Assheton, and H. E. Rayner. Studies in Indust. Hyg., No. 10, Rep. Dir.-Gen. Pub. Health, New South Wales, for 1926, Section I.—C, Indust. Hyg., pp. 49–72. Sydney, 1928.*

This is a study of ventilation in two large theaters in Sydney, carried out over a period of twelve months for the purpose of determining the atmospheric conditions which are conducive to comfort.

Instead of indicating sensations of comfort as cold, cool, comfortable, warm, and hot, the authors chose Vernon's eightfold scale of sensations of air movement. Apparently, in adopting this scale, they classified hot conditions as very stagnant and assigned to them the mark 0; comfortable conditions as medium with the assigned mark 4; and cold conditions as very fresh with the mark 8.

The comfort of atmospheric conditions was judged by two investigators, who also took sling psychrometer and kata-thermometer readings in the stalls, dress circle, and gallery of the theaters, prior to recording their own sensations. Air changes and carbon dioxide content of the air in the theaters which were determined by others were found to have no apparent influence on comfort. The observations were made during night performances. Altogether 226 sensations of comfort were recorded by the two investigators during the year, 40 per cent. of which were uncomfortable, 44 per cent. comfortable, and 16 per cent. very comfortable. By selecting votes with marks between 3 and 3.5, the authors constructed charts and derived equations which give the air movement required to produce comfort at different dry bulb temperatures and absolute humidities.

According to the reviewer's experience, the comfort zone for a mixed audience cannot be established from the opinion of two individuals. The comfort zone for men, women, and children varies, on account of differences in age, sex, clothing, occupation, and personal idiosyncrasies. The only satisfactory method of determining an average comfort zone for this group is to obtain a large number of individual votes from the audience itself, which was not done in this investigation.

A second exception which might be taken to the methods used is that the investigators in the stalls, dress circle, and gallery were not exposed to the counteracting radiant environment of the audience. Moreover, they were not at rest, but were engaged in manipulating the sling psychrometer, a procedure which requires an appreciable effort.

In the reviewer's opinion, the comfort charts and conclusions drawn from them are not supported by sufficient data, and, indeed, are erroneous. In appendix Ia, for example, comfort curves are drawn with air movement in feet per minute as abscissas and dry bulb temperature as ordinates, for absolute humidities of from 4 to 8 grains per cubic foot of air. These curves are shown to become asymptotic to the temperature axis at low air velocities, indicating that with still air the dry bulb temperature necessary to produce comfort must be much below 60°F. Taking the 5 grain comfort curve, which represents the average humidity conditions in the Sydney theaters, the comfortable dry bulb

temperature is shown to be 60°F. when the air movement is 15 feet per minute and 69.2°F. when it is 20 feet per minute. In other words, an increase of 5 feet a minute in the velocity of the air produces a cooling effect which is equivalent to 9.2°F. in dry bulb temperature. If the air movement is kept constant at 25 feet a minute, and the absolute humidity decreased from 6 to 5 grains per cubic foot, the comfort curves show that the dry bulb temperature must be increased from 60° to about 72.5°F.

A comparison of these conclusions with those of Vernon and those of the Pittsburgh laboratory of the American Society of Heating and Ventilating Engineers reveals that the influences of humidity and of air movement are grossly exaggerated, especially at low air temperatures. In this connection, the authors state: "To us it appears that the English school has paid less regard than it behoves us to pay to the question of absolute humidity, and that the American school has not fully appreciated the value of small air movement in the production of comfort." This in itself is very true; it does not, however, convince one that the authors have solved their problem satisfactorily or that their conclusions are justified on the basis of the evidence presented.—C. P. Y.

REPORT OF COMMITTEE ON HEATING AND VENTILATING GARAGES. *Jour. Am. Soc. Heating and Ventil. Eng., July, 1928, vol. 34, pp. 565–567.*

STUDIES IN SCHOOL VENTILATION. *R. F. Heath and J. S. Patterson. Abstr. as follows from Contract Rec. and Engin. Rev., 1928, vol. 42, pp. 8–13, in Chem. Abstr., May 10, 1928, vol. 22, p. 1642.*

A discussion of observations made in a school building in Toronto equipped with a ventilation unit comprising tempering coils, ozonator, air washer of spray type, and reheater. The observations made included temperature, humidity, and dry and wet kata-thermometer readings. The air washer does not remove odors to any great extent. Introduction of 0.013 parts per million ozone effected some improvement but did not eliminate all odors.

EFFECTS OF MECHANICAL AND NATURAL VENTILATION ON THE HEALTH OF SCHOOL CHILDREN. *T. J. Duffield. Jour. Am. Soc. Heating and Ventil. Eng., April, 1928, vol. 34, pp. 327–358.*

This preliminary report on the second study of the New York State Commission on Ventilation on the effect of ventilation on the health of schoolchildren, carried on for the purpose of confirming the previous findings of the Commission in the schools of New York City during 1913 to 1917, gives the results of observations in six schools of Syracuse, N. Y. Three of these schools were ventilated mechanically and heated by the modern split system. The other three were old furnace heated schools, ventilated by natural means. In the selection of these schools, no attention was paid to age, sex, nationality, or social status of the pupils. The relative merits of these two types of ventilation were judged by the comparative incidence and duration of colds and sore throats, the diagnosis of which rested largely with the teachers and parents. Such unreliable methods of

diagnosis undoubtedly introduce an element of weakness into the data.

Generally speaking, the Syracuse study substantiates the previous findings of the Commission. According to the rough data secured, the mechanically ventilated schools showed an excess of 47 per cent. in total absenteeism; an excess of 67 per cent. in absenteeism due to respiratory illness; an excess of 80 per cent. in respiratory illness among pupils present and of 77 per cent. among pupils present and absent. These percentages must not be taken too literally, because the greater part of this excess is accounted for by differences in age and racial and social characteristics of the pupils. The author endeavored to balance the influence of these factors by eliminating one mechanically ventilated school and one naturally ventilated school and restricting his comparison to grades two to six. Even this more careful comparison, however, showed that the superiority of the naturally ventilated schools persists. The total absenteeism in the mechanically ventilated schools was found to be 29 per cent. greater than in the naturally ventilated schools, absenteeism due to respiratory illness was 32 per cent. higher, the respiratory illness among pupils present was 13 per cent. higher, and for all respiratory illness the excess was 17 per cent.

In addition to numerous tables, charts are given showing correlation of indoor and outdoor temperature, precipitation, racial stock and grade of pupils to absenteeism from respiratory illness.

Although imperfect in many respects, these findings are of great significance. They strengthen the belief that no mechanical system of ventilation, however perfect, is capable of reproducing the wholesome and healthful condition of the outdoor atmosphere during the spring and fall. Just what this vital property in the outdoor air is, is a matter of conjecture; it may be electrical, physical, or chemical.

A previous conclusion of the Commission to the effect that respiratory illness in pupils is chiefly caused by excessive indoor temperature is not confirmed in this study. The author is inclined to believe that it may be due rather to the greater volume of air circulated through the rooms, which causes excessive evaporation from the skin and predisposes pupils to respiratory disease. Further studies will be undertaken to prove this hypothesis.

One is impressed by the author's endeavor to show impartiality in treating this controversy of long standing. He concludes in part:

> If our original data had been based on the more reliable foundation of diagnosis of respiratory illness by competent persons, and had our follow-up of absentees been such as to preclude the possibility of falsification of cause of absence, and had the numbers of individuals included in our study been greater, we should be warranted in making the unqualified assertion of what this preliminary study strongly suggests, namely, that natural ventilation has some inherent virtue which mechanical ventilation does not possess, or that mechanical ventilation involves some harmful influence from which natural ventilation is free.

The author warns the reader against hasty or rigid deductions from this progress report.

It is encouraging to know that these studies are being continued under improved conditions, with the promise of more reliable results.—C. P. Y.

SUBJECT INDEX TO VOLUME X

This is a subject index to all the reading matter in the ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE, and one should, therefore, look for the subject word. The name of the author follows the subject entry in parenthesis.

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